THE

AMERICAN GAS-LIGHT JOURNAL.

THE OFFICIAL GAZETTE OF

LIGHT, HEAT, WATER-SUPPLY, AND SEWERAGE.

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PETROLEUM ITEMS.

PETROLEUM FOR AFRICA.—A house in Toronto, C. W., have just filled an order for two thousand gallons of oil for the colony of Natal.

DESTRUCTION OF PETROLEUM BY FIRE AT MONTREAL.—A destructive fire occurred at Montreal, C. E, on June 2d, by which a large amount of property was destroyed. The conflagration originated in the oil-sheds of the Grand Trunk, at the upper end of the Canal Basin. In these sheds were stored between 2,000 and 3,000 barrels of petroleum, and a number of men were at work there at the time, when the flames suddenly appeared, and in a few minutes were breaking through the roof. The fire is supposed to have originated from the flame of a candle. The workmen were compelled to leave their clothes, and escape by taking to the water and floating on pieces of timber. The Montreal witness says:

"The oil escaped from the barrels and, as they burst, vast jets of flame shot upward, only to be enveloped the next instant in a cloud of the densest smoke. The sight soon became terribly grand. The oil spread over the wharf and upon the water, burning wherever it ran, and igniting a large pile of lumber belonging to M. K. Dickson, forwarder, and soon seizing upon several hundred tons of coal, the property of Mr. Copleand.

"Meantime, the steamer *Alert* and three barges were lying moored at the wharf, and one of the latter was got off, but the others, including the steamer, were laid hold of by the devouring element. They at length drifted away, and the steamer—an old one, belonging to Mr. M. K. Dickinson, out of which the engines had been taken—burned to the water's edge; the two barges reached the neighborhood of Mr. Gould's City Mills, where the firemen played upon them, and at length extinguished the flames after their decks and other portions were destroyed. All this time the wind was blowing very strong, and a slight change in its direction might have been fatal either to these mills, as well as to the oil-mills of Messrs. Lymans & Clare, or to the sheds and craft in the opposite quarter. Masses of burning timber were floating downwards, but these were extinguished, or else guided by parties in boats so as to do no damage, whilst several barges removed to a higher situation. A Grand Trunk car, laden with barrels of petroleum, which had been standing near the shed, waiting to be discharged, had been burned, and the sleepers of the railway-track laid down to this place, as also a quantity of material belonging to the Grand Trunk, were now on fire, the flames being hindered from making rapid progress only by the superincumbent earth and the exertions of the firemen. But to the immediate right of the track might be said to be the core of the disaster. It was here where the oil-shed had stood, and where the flames, although diminished in height, were still raging with a sort of savage intensity, grovelling over the embers, and causing the water beneath and around them to simmer, and even boil, and the steam to ascend from the remoter part of the now tepid pool, whilst over all arose a noise compounded of a mingled hiss and roar, and amidst the fire appeared a heap of iron hoops, looking like a multitude of charred skeletons. But the material on which the burning element had fed was fast being exhausted, and by midnight all further danger seemed past. During the night the fire gradually fell, and the next day was merely smouldering. We may add that the coal mentioned was but little consumed, owing to the strenuous exertions of the firemen, also that the roof of Lymans & Clare's mills was slightly injured."

NEW PETROLEUM ENTERPRISE.—We understand that a company has been formed in the neighborhood of Sparta, with a capital of a thousand dollars, to prospect for coal-oil near New Sarum, about seven miles east of this town. The indications of oil in that quarter, we understand, are quite strong, so much so that the best and most influential farmers have subscribed to the capital stock without hesitation. Tenders are asked for digging a well.—*St. Thomas Home Journal.*

PETROLEUM FOR LIGHTHOUSES.—The London *Grocer* informs us that at a meeting of the Mersey Dock Board, held on Thursday, May 21, the proceedings included the following report from Lieut. Parks, R. N., the marine surveyer, on the letter of Mr. Prentiss, proposing the use of petroleum in lieu of colza and olive oil, at the lighthouses and lightships:

The marine surveyor having been ordered to report on the letter of Mr. Prentiss, proposing to use petroleum as a substitute for olive or colza oil for lighthouse purposes, has to inform the committee that the subject having been already mentioned, he had procured a sample, and requested the engineer to test it, together with the samples of olive and colza oil recently under consideration.

The result of that test was reported by the engineer on Tuesday last, and it appears that the oil burned for ten minutes, giving a good flame, when an explosion took place, blowing the lamp to atoms.

The lamp used was the ordinary lighthouse lamp as at present in use, and the disaster is partly to be attributed to the fact that the lamp in question was unsuited for the description of oil to which it was applied; this being the case, it becomes obvious that a change from olive or colza oil to petroleum, must involve the sacrifice of the lighting apparatus at present in use, and the purchase of lamps proper for the purpose.

The fact of an explosion having occurred, however, opens the question of risk arising from the use of the new substitute, as it is quite certain that no description of lamp in use could entail such a disaster by the combustion of colza or olive oil.

It is the nature of petroleum to volatise at a very low temperature, setting free a highly inflammable gas; and the explosion which has taken place testifies to this fact. On purchasing the sample in question, the marine surveyor received an assurance that the burning of petroleum involved no danger—"that it was as safe as water." It was thought right to test the matter before sending the sample to the engineer, when a piece of lighted paper, dropped into a saucer of the oil, almost instantaneously involved the whole surface in a fierce flame; indeed, lamps constructed for the use of petroleum, are similar in principle to those used for spirits of wine, naphtha, &c., intended to act upon the property described, viz., that of volatilising at a low temperature.

In these lighthouses, where several lamps are used, the heat from the concentration of many flames, is very considerable; much greater than is requisite to set free the inflammable gas of petroleum. In the single lamp used at the Ormshead, to produce the required amount of light, the heat is so great that instances have occurred of the melting of the wick-holders. In either of these cases, therefore, the use of petroleum must involve constant risk of unexpected combustion; and in the lightships, where the motion of the vessels sometimes not only fills the bottom of the lanterns with oil, but the oil runs down on the decks, a piece of broken wick falling from a lamp by the motion of the vessel, in the nightly repeated process of trimming, would, in all probability, involve the burning of the ship.

Mr. Darbyshire moved the confirmation of the proceedings. He thought the report of the marine surveyor upon petroleum oil was conclusive—at all events, till some new lamps were discovered. With regard to the alterations in the light-houses, the engineer had found that such was the dilapidated state of the Lower Lighthouse, that it would be totally impossible to repair it, and that it was necessary to rebuild it entirely. If the proposed change of site could be effected, they could go on without disturbing the present lights till the new building was finished.

Mr. Fernie seconded the motion, which was agreed to.

GAS CELEBRATION IN LONDON.

An English paper gives an account of a banquet given by the governor, deputy-governor, and directors of the Chartered Gas Company to the chairman, deputy-chairman, and secretaries of the Metropolitan Gas Companies to celebrate the first jubilee of the first gas company that was ever established. On the 31st of December, 1862, the Chartered Gas Company entered upon the fiftieth year of their incorporation, and during the half century they have been in existence they have had times of struggling to overcome great difculties, as well as abundant success. The paper from which we quote says:

"The history of the Chartered Company and the history of gas-lighting are so closely associated that they are almost identical; for though Murdoch and Clegg had previously shown the practicability of the application of coal-gas to illumination, and Winsor had, for a few years, undauntedly contended to introduce what he termed his 'discovery,' the wild and fanciful schemes of the latter did not assume a practical form until they were embodied in the Chartered Company, which his assiduity and perseverance were the means of establishing. The governor, at the last half-yearly meeting, appropriately alluded to the difficulties and prejudices against which the company had to contend in the first years of their efforts to introduce so novel a mode of illumination, and to the want of success that for some time discouraged them; and, contrasting that period of loss and depression with the present flourishing condition of their affairs, he congratulated the shareholders that, notwithstanding the enormous cost of erecting works in the first instance, when every step in advance was experimental, the company had not only maintained their ground, but had been enabled to pay as large a dividend as any other gas company in the kingdom. It was not until six years after the Chartered Company were incorporated that the investment of capital in gas-works ceased to be regarded as a most hazardous speculation. After that time, more confidence was placed in such undertakings. The Chartered then considerably extended their works, and many provisional companies were founded; but it was only in 1824 that the Imperial Company first laid their mains in the extensive district they now occupy. In the same year the Phœnix Company was founded, having for their object to purchase a small gas-work belonging to private individuals in Southwark. From that period, the extension of gas companies has rapidly progressed; and, though occasionally checked by reverses, unexampled prosperity is now, with but few exceptions, the order of the day."

COCHINEAL SUPERSEDED BY ANILINE.—The *Scientific American* says that cochineal, which formerly commanded an enormous price, has been, to a great extent, superseded by aniline. This aniline is now worth eighty dollars a pound. We need hardly remind our readers that it is extracted from coal-tar, and that it is superior to cochineal from the fact that it gives, by different treatments, every shade of purple, from the deepest royal to the faintest lilac—every variety of blue, from the pale tint of blue sky to the deepest ultra marine, and all the gradations of scarlet and crimson.

GAS-LIGHT COMPANIES IN THE UNITED STATES.

Compiled from official sources expressly for the AMERICAN GAS-LIGHT JOURNAL.

CORRECTED BY JOHN B. MURRAY, No. 39 NASSAU STREET, NEW YORK, DEALER IN GAS-LIGHT SHARES.

No.	Chartered.	Town.	State.	Chartered Capital.	Par Val. Per Sh. $	Semi-Ann'l Div'd.	Dividends Payable.	Population of Gas District.	Price per 1000 Feet.	Asked pr. cent.	Offered pr. cent.	REMARKS.
1	1857	ADRIAN	Mich.	50,000	50	—	May & November.	4,000	3 50	....	....	
2	1856	AKRON	O.	20,000	33⅓	—	Do.	3,500	3 00	....	....	
3	1845	ALBANY	N. Y.	25 ,000	20	4	January & July.	65,000	3 00	120	....	None in market.
4	1858	ALBION	N. Y.	30,000	100	—	Do.	3,000	3 80	....	....	
5	1851	ALEXANDRIA	Va.	106,530	—	—	City Works.	9,000	3 50	....	....	
6	1852	ALLEGHANY	Pa.	200,000	25	4	May & November.	25,000	3 00	....	....	
7	1858	ALLENTOWN	Pa.	60,000	100	3½	Do.	5,000	3 50	....	....	
8	1857	ALTON	Ill.	75,000	—	—	Private Works.	4,000	3 50	....	....	
9	1859	ALTOONA	Pa.	40,000	20	4	January & July.	5,000	3 00	....	....	
10	1859	AMESBURY AND SALISBURY	Mass.	30,000	25	—	Do.	7,000	4 00	....	....	
11	1856	ANNAPOLIS	Md.	100,000	25	—	Do.	4,000	4 00	....	....	
12	1858	ANN ARBOR	Mich.	23,000	50	5	March & September.	5,500	4 00	....	....	
13	1858	ASTORIA	N. Y.	20,000	50	—	Do.	6,000	4 00	....	....	
14	1855	ATLANTA	Ga.	50,000	25	5	January & July.	12,000	5 00	....	....	
15	1857	ATTLEBORO'	Mass.	6,000	50	3	Do.	2,000	6 00	....	....	
16	1850	AUBURN	N. Y.	80,000	50	5	Do.	10,000	7 00	....	....	
17	1851	AUGUSTA	Ga.	80,000	25	8	Do.	9,000	6 00	....	....	
18	1858	AUGUSTA AND HALLOWELL	Me.	84,700	50	5	Do.	10,000	4 00	....	....	
19	1860	AURORA	Ind.	10,000	—	—	Private Works.	3,500	3 50	....	....	Formerly used Sanders' Water-Gas. Recently altered to Coal Gas-Works.
20	1817	BALTIMORE	Md.	550,000	100	5	June & December.	150,000	2 50	150	....	None for sale.
1	1852	BANGOR	Me.	120,000	100	4	January & July.	12,000	3 50	....	....	
2	1855	BATAVIA	N. Y.	32,000	20	4	Do.	2,500	4 00	....	....	
3	1858	BATH	Me.	65,000	100	3	April & October.	10,000	3 75	....	....	
4	1859	BATH	N. Y.	15,000	50	—	May & November.	3,000	7 00	....	....	
5	1861	BATTLE CREEK	Mich.	15,000	—	—	January & July.			....	....	
6	1858	BELFAST	Me.	14,000	100	—	Do.	7,000	7 00	....	....	
7	1856	BELLEFONT	Pa.	20,000	25	2	Do.	8,500	4 00	....	....	
8		BELOIT	Wis.	30,000	—	—	Do.	4,000	4 00	....	....	
9	1854	BETHLEHEM	Pa.	50,000	50	4	June & December.	2,000	3 20	...	....	
30	1859	BEVERLY	Mass.	40,000	100	—	January & July.	4,000	4 00	....	....	
1	1853	BINGHAMPTON	N. Y.	50,000	50	3½	Do.	10,000	4 00	....	....	
2	1859	BIRMINGHAM	Pa.	40,000	50	—	Do.	4,000	4 00	....	....	
3	1855	BLOOMINGTON	Ill.	40,000	50	—	Do.	6,000	4 00	...	....	
4	1853	BORDENTOWN	N. J.	50,000	25	3	June & December.	4,000	3 80	....	....	
5	1822	BOSTON	Mass.	1,000,000	500	5	Do.	130,000	2 25	....	....	
6	1859	BRATTLEBORO'	Vt.	21,000	—	—	Do.	3,000	4 00	....	....	
7	1851	BRIDGEPORT	Ct.	90,000	25	4	January & July.	10,000	4 00	90	....	Passed last dividend.
8	1857	BRIDGETON	N. J.	50,000	20	—	Do.	5,000	4 00	....	....	
9	1856	BRISTOL	Pa.	30,000	25	3	February & August.	3,000	4 00	....	....	
40	1855	BRISTOL	R. I.	35,000	50	2	January & July.	6,000	4 00	....	....	
1	1859	BROCKPORT	N. Y.	25,000	100	3	Do.	1,500	4 00	....	....	
2	1858	BROOKLINE	Mass.	66,000	100	4	February & August.	3,500	4 00	....	....	
3	1825	BROOKLYN	N. Y.	2,000,000	25	5	January & July.	75,000	2 50	170	160	
4		BROWNSVILLE	Pa.				Do.			....	....	
5	1848	BUFFALO	N. Y.	600,000	50	5	Do.	70,000	2 90	140	125	
6	1852	BURLINGTON	N. J.	100,000	25	3½	Do.	5,000	4 00	105	....	
7	1858	BURLINGTON	Vt.	75,000	25	2½	Do.	10,000	4 50	....	....	
8	1859	BURLINGTON	Iowa.	65,000	50	—	Do.	8,000	4 00	....	....	
9	1861	CALAIS	Me.	90,000	100	—	Do.	10,000	3 50	....	....	
50	1852	CAMBRIDGE	Mass.	300,000	100	5	February & August.	20,000	3 50	100	97½	
1	1853	CAMDEN	N. J.	300,000	100	3	April & October.	15,000	3 50	105	100	
2	1853	CANANDAIGUA	N. Y.	50,000	50	—	January & July.	3,000	4 00	90	80	
3	1856	CANTON	O.	19,000	50	6	March & September.	6,000	3 00	....	....	
4	1853	CAPE ISLAND	N. J.	80,000	100	—	October.	10,000	6 00	....	....	Watering place.—These Works only run in summer.
5	1860	CARBONDALE	Pa.	16,000	25	—	March & September.	5,000	4 00	....	....	
6	1855	CARLISLE	Pa.	30,000	25	—	January & July.	4,000	4 00	....	....	
7	1856	CATASAUQUA	Pa.	15,000	25	5	May & November.	2,000	4 00	....	....	
8	1858	CATSKILL	N. Y.			—	Private Works.	3,000	3 00	....	....	Owned by G. T. Sutton.
9	1857	CHAMBERSBURG	Pa.	30,000	25	—	January & July.	3,000	4 00	....	....	
60	1846	CHARLESTON	S. C.	723,800	25	4	Do.	50,000	4 00	....	....	
1	1851	CHARLESTOWN	Mass.	200,000	50	4	Do.	30,000	3 00	105	....	
2	1858	CHARLOTTE	N. C.	14,000	50	10	March & September.	3,500	6 00	....	....	
3	1859	CHARLOTTEVILLE	Vt.	15,000	25	—	Do.	4,000	4 50	....	....	
4	1851	CHELSEA	Mass.	100,000	100	3½	January & July.	8,000	3 50	....	....	
5	1856	CHESTER	Pa.	35,000	25	3	April & October.	4,000	4 00	....	....	
6	1849	CHICAGO	Ill.	1,800,000	25	5	January & July.	100,000	2 50	150	140	Very scarce. Stock wanted.
7	1857	CHICOPEE	Mass.	50,000	20	—	Do.		4 00	....	....	
8	1851	CHILLICOTHE	O.	40,000	25	4	Do.	12,000	3 50	....	....	
9	1841	CINCINNATI	O.	1,600,000	100	5	Do.	225,000	2 50	....	....	
70	1859	CITIZENS', BROOKLYN	N. Y.	1,000,000	20	—	Do.	135,000	2 00	128	125	
1		CLARKESVILLE	Tenn.	100,000	50	—	Do.	5,000	4 00	....	....	
2	1860	CLAREMONT	N. H.	20 000	100	—	March & September.	3,000	4 00	....	....	
3	1846	CLEVELAND	O.	200,000	10	5	January & July.	20,000	3 00	....	....	
4	1858	CLINTON	Mass.	30,000	500	5	Do.	3,000	4 00	....	....	
5	1859	CLYDE	N. Y.	10,000	50	4	Do.	2,500	4 00	...	....	
6	1854	COHOES	N. Y.	50,000	20	3½	April & October.	5,000	3 60	....	....	
7	1860	COLD SPRING	N. Y.	30,000	50	—	Do.	3,500	4 00	80	....	Formerly Rosin-Gas, but now Coal. A well managed company. Stock firmly held.
8	1860	COLD WATER	Mich.	25,000	50	5	January & July.	4,000	4 00	....	....	
9	1852	COLUMBIA	Pa.	37,500	25	—	Do.	4,000	3 50	....	....	
80	1852	COLUMBIA	S. C.	44,000	25	4	Do.	6,000	6 00	....	....	
1	1857	COLUMBIA	Cal.	50,000	25	—	Do.	4,500	10 00	....	....	
2	1853	COLUMBUS	Ga.	54,000	25	5	Do.	5,000	7 00	....	....	
3	1850	COLUMBUS	O.	100,000	10	6	Do.	30,000	3 00	....	....	
4	1853	CONCORD	N. H.	50,000	50	5	Do.	8,000	3 50	....	....	
5	1858	COVINGTON AND NEWPORT	Ky.	100,000	50	3½	Do.	28,000	4 00	...	....	
6	1854	CUMBERLAND	Md.	60,000	50	3	Do.	6,000	4 00	....	....	
7	1857	DANBURY	Ct.	50,000	25	4	Do.	2,000	3 75	....	...	
8	1856	DANVILLE	Pa.	30,000	25	—	June & December.	3,000	4 00	....	....	
9	1855	DAVENPORT	Iowa.	56,000	100	—	Do.	6,000	5 00	....	....	
90	1848	DAYTON	O.	50,000	25	5	February & August.	8,000	3 50	....	....	
1	1853	DEDHAM	Mass.	40,000	50	—	January & July.	3,000	4 00	....	....	
2	1860	DELAWARE	O.	30,000	25	—	Do.	2,500	3 00	....	....	
3	1849	DETROIT	Mich.	500,000	50	5	Do.	30,000	3 50	160	150	Excellent Stock. No sales.
4	1860	DOBBS' FERRY	N. Y.	25,000	—	—	Do.	3,000	4 00	....	....	
5	1854	DORCHESTER	Mass.	150,000	100	—	Do.	14,000	4 00	....	....	
6	1859	DOVER	Del.	12,000	—	—	Private Works.	2,000	4 00	....	....	
7		DOVER	N. H.				January & July.			....	....	
8	1857	DOYLESTOWN	Pa.	50,000	—	—	Do.	3,000	4 00	....	....	
9	1854	DUBUQUE	Iowa.	100,000	50	—	Do.	17,000	4 50	....	....	
100	1853	EAST BOSTON	Mass.	133,000	25	4	Do.	20,000	3 50	....	145	No transactions.
1	1838	EAST GREENWICH	R. I.	11,200	100	15	Do.	3,000	7 00	....	....	
2	1861	EAST HAMPTON	Mass.	10,000	25	—	Do.	5,000	9 00	....	....	
3	1861	EAST NEW YORK	N. Y.	50,000	50	—	Do.	12,000	3 50	....	....	
4	1857	EASTON	Md.	9,000	10	—	Do.	1,500	7 00	....	....	
5	1850	EASTON	Pa.	125,000	50	4	June & December.	6,000	3 60	....	....	
6	1856	EASTPORT	Me.	50,000	55	—	Do.	3,000	4 00	....	....	
7	1855	ELIZABETH	N. J.	100,000	20	4	January & July.	14,000	3 50	....	....	
8		ELLICOTT'S MILLS	Md.	10,000	—	—	Do.	4,000	4 00	....	....	
9	1852	ELMIRA	N. Y.	50,000	25	3½	Do.	5,000	4 00	....	...	
110	1852	ERIE	Pa.	68,000	50	3½	June & December.	10,000	3 00	....	....	
11	1853	EVANSVILLE	Ind.	60,000	50	4	January & July.	12,000	4 00	110	....	A very good Company.
12		EXETER	N. H.	60,000	—	—	Do.	12,000			...	
13		FAIR HAVEN	Ct.	20,000	25		Do.	8,000	4 00	....	....	
14	1847	FALL RIVER	Mass.	26,000	—	—	Private Works.	12,000	3 50	....	....	
15	1839	FAYETTEVILLE	N. C.	25,000	100	6	January & July.	7,000	6 00	....	....	
16		FIFTH WARD (Milwaukee)	Wis.	50,000	25	—	Do.	10,000	4 00	....	....	
17	1857	FISHKILL	N. Y.	10,000	20	—	April & October.	1,500	9 00	....	....	
18	1853	FITCHBURG	Mass.	100,000	50	3	January & July.	5,000	4 00	....	....	Make Petroleum-Gas.
19	1859	FLEMINGTON	N. J.	20,000	—	—	Do.	3,000	4 00	....	....	
120	1855	FLUSHING	N. Y.	40,000	50	1½	March & September.	6,500	4 00	....	....	
21	1858	FORT WAYNE	Ind.	50,000	25	—	Do.	6,000	4 00	....	....	
22	1851	FRANKFORT	Ky.	80,000	—	—	City Works.	5,500	4 50	...	....	
23	1851	FREDERICK CITY	Md.	36,000	100	—	January & July.	5,000	6 70	....	....	
24	1854	FREDERICKSBURG	Va.	72,500	50	5	Do.	4,500	4 00	....	....	
25	1858	FREDONIA (Natural Gas)	N. Y.	10,000	100	—	Do.	2,000	4 00	....	....	Unlimited supply of Natural Gas.
26	1856	FREEPORT	Ill.	20,000	100	—	May & November.	10,000	4 00	....	...	

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127	1859	Fremont	O.	25,000	25	—	May & November.	2,000	4 50	....	....	
28	1858	Fulton	N. Y.	12,000	100	—	Do.	4,000	7 00	....	....	
										....	....	
29	1855	Galena	Ill.	70,000	100	—	Do.	8,000	4 00	....	....	
130	1859	Galion	O.	25,000	25	—	January & July.	1,800	3 00	....	....	
31	1858	Galveston	Texas.	150,000	50	—	May & November.	7,000	6 00	....	....	
32	1854	Gardiner	Me.	100,000	50	4	Do.	8,000	4 00	....	....	
33	1853	Geneva	N. Y.	75,000	25	2½	Do.	6,000	4 00	....	....	
34	1851	Germantown	Pa.	Merged	into	the	Philadelphia Works.	12,000	2 25	....	....	
35	1859	Gettysburg	Pa.	20,000	50	3	January & July.	2,500	4 00	....	....	
36	1854	Glenn's Falls	N. Y.	35,000	50	3	February & August.	4,000	4 00	....	....	
37	1854	Gloucester	Mass.	40,000	50	—	January & July.	5,000	3 50	....	....	
38	1857	Gloversville	N. Y.	15,000	25	—	Do.	3,000	3 50	....	....	
39	1858	Grand Rapids	Mich.	50,000	20	—	Do.	5,000	4 00	....	....	
140	1855	Great Barrington	Mass.	5,000	100	5	April & October.	2,000	7 00	....	....	
41	1849	Great Falls	N. H.	50,000	100	3	Do.	3,000	4 00	....	....	
42	1860	Greenfield	Mass.	20,000	50	2	January & July.	2,500	4 00	....	....	
43	1853	Greenpoint	N. Y.	100,000	50	5	Do.	20,000	3 00	....	....	Close corporation.
44	1859	Greensboro'	N. C.	12,000	50	—	April & October.	3,000	7 00	....	....	
45	1858	Greensburg	Pa.	30,000	25	3	May & November.	2,000	3 00	....	....	
46	1854	Hagerstown	Md.	15,000	20	—	January & July.	2,000	6 00	....	....	
47		Hamilton	O.	15,000			Do.			....	....	
48	1859	Hannibal	Mo.	100,000	100	—	Do.	6,000	3 50	....	....	
49	1857	Harlem	N. Y.	350,000	50	3½	Do.	25,000	3 00	....	145	
150	1855	Harrisburg	Pa.	100,000	—	4	Do.	5,000	4 00	....	....	
51	1849	Hartford	Ct.	200,000	25	4	Do.	25,000	3 00	150	140	Stock in demand.
52		Hastings	N. Y.				Do.	8,000	4 00	....	....	
53	1853	Haverhill	Mass.	50,000	50	—	Do.	5,000	4 00	....	....	
54	1859	Haverstraw	N. Y.	20,000	100	—	Do.	5,000	4 00	....	....	
55	1861	Hayesville	Mass.	15,000	25		Do.	4,000	4 00	....	....	
56	1859	Hempstead	N. Y.	16,000	25	—	Do.	1,000	4 00	....	....	
57	1862	Hoboken	N. J.	100,000	25	3	Do.	30,000	2 50	....	100	Works not yet built.
58	1856	Hollidaysburg	Pa.	30,000	25	2	Do.	4,000	3 50	....	....	
59	1861	Holyoke	Mass.	20,000	25	—	Do.	3,000	4 00	....	....	
160	1861	Homer & Cortlandt	N. Y.	40,000	100	—	Do.	6,000	4 00	....	....	
61	1854	Honesdale	Pa.	30,000	25	3	Do.	2,500	4 00	....	....	
62	1860	Hornellsville	N. Y.	12,000	50	—	Do.	2,000	4 00	....	....	
63	1858	Hudson	N. Y.	50,000	100	3½	February & August.	3,000	4 00	....	....	
64	1857	Huntington	Pa.	18,000	50	3	Do.	2,000	3 50	....	....	
65	1856	Huntsville	Ala.	7,825	25	—	June & December.	2,000	5 00	....	....	
66		Indianapolis	Ind.	150,000	—	—	Do.	15,000	5 00	....	....	
67	1857	Iowa City	Iowa.	40,000	50	—	February & August.	4,000	4 50	....	....	
68	1852	Ithaca	N. Y.	75,000	25	3½	January & July.	6,000	4 00	....	....	
69	1857	Jackson	Mich.	25,000	50	5	Do.	6,000	3 50	....	....	
170		Jackson	Miss.	80,000	50	—	Do.	4,000	4 50	....	....	
71		Jackson	Cal.	50,000	30	—	Do.	4,000	10 00	....	....	
72		Jacksonville	Flor.	30,000	20	—	Do.	2,000	7 00	....	....	
73		Jacksonville	Ind.	50,000	50	—	Do.	4,000	5 00	....	....	
74	1858	Jacksonville	Mo.	25,000	25	—	Do.	7,000	6 00	....	....	
75	1856	Jamaica	N. Y.	20,000	—	4	Do.	6,000	4 00	....	....	
76	1853	Jamaica Plain	Mass.	10,000	100	4	Do.	3,000	4 00	....	....	
77		Jamestown	N. Y.	25,000	—	—	Do.	4,000	4 00	....	....	
78	1856	Janesville	Wis.	50,000	100	—	Do.	12,000	4 00	....	....	
79		Jeffersonville	Md.	30,000	25		Do.	4,000	4 00	....	....	
180	1858	Jersey City	N. J.	300,000	—	5	Do.	30,000	3 00	150	....	No sales since formation of Hoboken Co.
81	1858	Jersey Shore	Pa.	15,000	25	—	Do.	2,000	3 70	....	....	
82	1856	Johnstown	Pa.	80,000	25	3	Do.	8,000	3 00	....	....	
83	1857	Joliet	Ill.	300,000	100	—	June & December.	6,000	4 00	....	....	
84	1858	Kalamazoo	Mich.	30,000	50	5	Do.	10,000	4 00	....	....	
85	1860	Keene	N. H.	60,000	100	—	Do.	4,500	4 00	....	....	
86	1855	Keokuk	Iowa.	100,000	100	—	January & July.	10,000	4 50	....	....	
87	1855	Kingston	Pa.	50,000	50	—	Do.	3,000	4 00	....	....	
88	1859	Kittanning	Pa.	20,000	—	—	Doubtful.	5,000	4 00	....	....	Said to be a fraud.
89	1854	Knoxville	Tenn.	65,000	—	—	April & October.	4,000	5 00	....	....	
190	1860	Laconia	N. H.	20,000	100	—	Do.	4,000	6 00	....	....	
91	1859	La Crosse City	Wis.	100,000	50	—	June & December.	10,000	5 00	....	....	
92	1854	Lafayette	Ind.	60,000	50	4	January & July.	10,000	3 25	....	....	
93	1856	Lambertville	N. J.	30,000	25	—	Do.	2,600	4 00	....	....	
94	1849	Lancaster	Pa.	100,000	50	4	Do.	10,000	3 00	....	....	
95	1856	Lancaster	O.	25,000	100	5	Do.	5,000	3 50	....	....	
96	1855	Lansinburg	N. Y.	25,000	100	—	Private Works.	7,000	4 00	....	....	
97	1849	Lawrence	Mass.	200,000	100	4	February & August.	15,000	3 50	....	....	
98	1859	Leavenworth	Kansas.	200,000	25	—	January & July.	10,000	5 00	....	....	
99	1856	Lebanon	Pa.	26,000	50	—	February & August.	5,000	4 00	....	....	
200	1861	Le Roy	N. Y.	25,000	50	—	Do.	4,000	4 00	....	....	
1	1858	Lewisburg	Pa.	20,000	100	—	January & July.	4,000	4 00	....	....	
2	1852	Lewiston	Me.	100,000	100	3	Do	10,000	3 20	....	....	
3	1856	Lewistown	Pa.	80,000	50	3	April & October.	3,000	3 10	....	....	
4	1853	Lexington	Ky.	100,000	25	4	January & July.	5,000	4 00	....	....	
5	1853	Little Falls	N. Y.	112,000	25	—	Do.	3,500	7 00	....	....	
6	1861	Little Rock	Ark.	20,000	—	—	Do.	5,000	6 00	....	....	
7	1858	Lockhaven	Pa.	28,000	—	—	Do.	3,000	4 00	....	....	
8		Lockport	N. Y.	100,000	50	—	Do.	4,000	4 00	....	....	
9	1838	Louisville	Ky.	600,000	50	6	Do.	80,000	2 50	125	....	But $481,400 stock has been sold. This Company has a large contingent fund and undivided profit on hand.
210	1849	Lowell	Mass.	200,000	25	5	Do.	50,000	3 25	....	....	
11	1852	Lynchburg	Va.	70,000	25	5	Do.	6,000	3 80	....	....	
12	1852	Lynn	Mass.	55,000	50	4	Do.	20,000	4 00	....	....	
13	1859	Lyons	N. Y.	30,000	100	—	Do.	4,000	4 00	....	....	
14	1852	Macon	Ga.	75,160	25	6	Do.	5,000	5 00	....	....	
15	1851	Madison	Ind.	160,000	25	3	Do.	10,100	3 50	....	....	
16	1855	Madison	Wis.	100,000	25	—	Do.	5,000	5 00	....	....	
17	1854	Malden & Melrose	Mass.	50,600	25	3	February & August.	5,000	4 00	....	....	
18	1852	Manayunk	Pa.	40,000	100	—	Do.	7,000	4 00	....	....	
19	1852	Manchester	N. H.	100,000	100	5	January & July.	25,000	3 00	....	....	
220	1830	Manhattan (N. Y. City)	N. Y.	4,000,000	50	5	Do.	600,000	2 50	300	375	
21		Mansfield	O.	25,000	—	—	Do.	10,000	4 00	....	....	
22	1854	Marblehead	Mass.	40,000	100	3	Do.	1,000	4 00	....	....	
23		Marlboro'	Mass.	20,000	—	—	Do.	8,000	4 00	....	....	
24		Mauch Chunk	Pa.	50,000	50	—	Do.	7,000	4 00	....	....	
25	1857	Marietta	O.	50,000	50	—	Do.	7,000	4 00	....	....	
26	1858	Marysville	Cal.	50,000	100	—	Do.	4,000	12 50	....	....	
27	1857	Massilon	O.	20,000	25	—	Do.	5,000	3 00	....	....	
28	1855	Meadville	Pa.	39,500	25	—	Do.	4,000	3 50	....	....	
29		Medina	N. Y.	2,000	100	—	Do.	2,000	7 00	....	....	
230	1852	Memphis	Tenn.	300,000	100	5	June & December.	12,000	3 50	....	....	
31		Meriden	Ct.	20,000			Do.			....	....	
32	1859	Metropolitan (N. Y. City)	N. Y.	1,000,000	100	—	January & July.	200,000	2 50	....	....	
33	1859	Middleboro'	Mass.	15,000	—	—	Private Works.		6 00	....	....	
34	1853	Middletown	Ct.	50,000	25	3	March & September.	5,000	3 80	....	....	
35		Middletown	N. Y.		25	—	Private Works.	3,000	3 00	....	....	Owned by G. T. Sutton.
36		Milford	Mass.	20,000	—	—	Do.		4 00	....	....	
37		Milledgeville	Ga.	100,000	50	—	Do.		5 00	....	....	
38		Milton	Pa.	10,000			Do.			....	....	
39	1847	Milwaukee	Wis.	400,000	50	5	January & July.	24,000	3 50	150	....	
240	1852	Mobile	Ala.	200,000	—	—	Do.	30,000	4 50	....	....	
41	1836	Monroe	Mich.	40,000	50	—	Do.	5,000	3 50	50	....	
42	1852	Montgomery	Ala.	100,000	25	4	February & August.	7,000	6 00	....	....	
43	1856	Montpelier	Vt.	30,000	25	3	January & July.	5,000	4 50	....	....	
44	1859	Morrisania	N. Y.	30,000	50	—	Do.		4 00	....	....	
45	1859	Morristown	N. J.	18,000	50	—	Do.	3,500	4 00	....	....	
46	1854	Mount Holly	N. J.	16,650	25	3	April & October.	2,000	7 00	....	....	
47		Mount Vernon	O.	50,000	100	—	Do.		4 00	....	....	
48	1857	Muscatine	Iowa.	50,000	100	—	January & July.	3,000	4 50	....	....	
49	1854	Nantucket	Mass.	50,000	100	3	February & August.	6,000	4 00	....	....	

GAS-LIGHT COMPANIES IN THE UNITED STATES.—Continued.

Compiled from official sources expressly for the AMERICAN GAS-LIGHT JOURNAL.

CORRECTED BY JOHN B. MURRAY, No. 39 NASSAU STREET, NEW YORK, DEALER IN GAS-LIGHT SHARES.

No.	Chartered.	Town.	State.	Chartered Capital.	Par Val. per Sh. $	Semi-Ann'l Div.	Dividends Payable.	Population of Gas District.	Price per 1000 Feet.	Asked pr. cent.	Offered pr. cent.	REMARKS.
250	1852	Nashua	N. H.	45,000	50	3½	January & July.	10,000	3 50	....	....	
51	1850	Nashville	Tenn.	200,000	50	5	Do.	25,000	3 50	....	....	
52	1858	Natchez	Miss.	46,000	50	—	Do.	20,000	5 00	....	....	
53	1852	New Albany	Ind.	200,000	50	3½	Do.	16,000	3 50	....	....	
54	1846	Newark	N. J.	362,000	50	5	Do.	45,000	3 62	130	....	Always a favorite stock.
55	1856	Newark	O.	30,000	100	—	Do.	7,000	5 40	....	....	
56	1852	New Bedford	Mass.	130 000	100	5	Do.	15,000	2 90	102	....	Well managed and kept quiet.
57	1859	Newbern	N. C.	22,000	100	6	Do.	6,000	3 50	....	....	
58		New Britain	Ct.	30,000	20	5	Do.	3,000	4 00	....	....	
59	1851	New Brunswick	N. J.	100,000	20	4	Do.	8,000	3 00	115	....	
260	1852	Newburg	N. Y.	67,000	20	4	Do.	10,000	4 00	105	....	
61	1852	Newburyport	Mass.	150,000	10	4	Do.	9,000	4 00	92½	....	
62	1857	Newcastle	Del.	32,500	10	3	Do.	4,000	4 00	90	....	
63	1847	New Haven	Ct.	250,000	25	4	Do.	30,000	3 00	155	....	None in market.
64	1858	New London	Ct.	70,000	50	3	Do.	12,000	4 00	105	....	Do.
65	1835	New Orleans	La.	1,500,000	100	6	Do.	120,000	4 50	180	....	
66	1853	Newport	R. I.	180,200	100	4	Do.	10,000	3 50	112	....	
67	1854	Newton & Watertown	Mass.	300,000	100	2	Do.	10,000	4 00	....	....	
68		Newton	N. J.	30,000	—	—	Do.	3,000	4 00	....	....	
69		Newton	Pa.	20,000	50	—	Do.	2,500	4 00	....	....	
270	1828	New York	N. Y.	1,000,000	50	5	May & November.	100,000	2 50	300	....	
71	1859	Niagara Falls	N. Y.	15,000	25	—	Do.	3,000	4 00	90	....	
72		Norfolk	Va.	60,000	25	—	Do.	40,000	4 00	....	....	
73	1858	Norristown	Pa.	41,700	25	4	June & December.	8,000	3 50	....	....	
74	1855	North Attleboro'	Mass.	50,000	100	3	Do.	6,000	4 00	....	....	
75		Northern Liberties	Pa.	400,000	25	7½	City Works.	40,000	2 50	....	....	
76		North Adams	Mass.	25,000	—	—	March & September.	30,000	4 00	....	....	
77	1856	Northampton	Mass.	35,000	25	3	January & July.	4,500	4 00	....	....	
78	1859	North Bridgewater	Mass.	16,000	100	4	June & December.	1,000	7 00	....	....	
79	1856	Norwalk	Ct.	30,000	150	4	February & August.	6,000	4 00	....	....	
80	1859	Norwalk	O.	30,000	25	—	January & July.	4,000	4 00	....	....	
281	1854	Norwich	Ct.	75,000	25	3½	Do.	12,000	3 50	....	....	
82	1861	Norwich	N. Y.	12,000	50	—	Do.	2,500	4 00	....	....	
83	1859	Nyack	N. Y.	20,000	100	—	Do.	2,500	4 00	....	....	
84	1860	Oberlin	O.	10,000	—	—	Do.	1,200	4 00	....	....	
85	1855	Ogdensburg	N. Y.	75,000	50	5	Do.	9,000	4 00	....	....	
86	1859	Orange	N. J.	65,000	25	—	Do.	6,000	3 50	....	....	Good works, built by Hoy, Jr., & Kennedy.
87	1852	Oswego	N. Y.	81,250	100	3½	Do.	15,000	4 00	105	....	
88	1855	Ottawa	Ill.	45,000	100	6½	Do.	6,000	4 00	....	....	
89	1856	Owego	N. Y.	40,000	50	3½	Do.	5,000	4 00	....	....	
290	1860	Owensboro'	Ky.	25,000	25	—	Do.	4,000	3 50	....	....	
91	1856	Paducah	Ky.	75,000	100	—	May & November.	4,000	5 00	....	....	
92	1861	Painesville	O.	40,000	25	5	Do.	2,500	5 00	....	....	
93	1856	Palmyra	N. Y.	12,000	25	—	January & July.	3,000	7 00	....	....	
94	1847	Paterson	N. J.	125,000	25	3	Do.	20,000	3 50	95	....	Surplus $10,000. May 15, 1863.
95	1850	Pawtucket	R. I.	75,000	50	4	Do.	12 000	3 00	....	....	Works leased to Gilbert T. Sutton.
96	1855	Peekskill	N. Y.	31,000	50	3	June & December.	4,000	4 00	....	....	
97	1860	Penn Yan	N. Y.	12,000	50	5	Do.	3,000	4 00	....	....	What is this Company doing?
98	1859	Peoples', Chicago	Ill.	500,000	50	New	Do.	100,000	2 50	....	....	
99	1855	Peoria	Ill.	100,000	50	4	Do.	8,000	3 50	....	....	
300	1852	Petersburg	Va.	120,000	—	5	January & July.	20,000	3 80	....	....	
1	1841	Philadelphia	Pa.	3,000,000	50	—	City Works.	650,000	2 00	....	....	
2	1855	Piqua	O.	50,000	50	—	January & July.	6,500	4 00	....	....	
3	1835	Pittsburg	Pa.	300,000	100	5	Do.	60,000	1 50	115	....	
4	1854	Pittsfield	Mass.	50,000	100	5	Do.	4,500	4 00	....	....	
5	1858	Placerville	Cal.	30,000	50	—	Do.	4,500	10 00	....	....	
6	1860	Plainfield	N. J.	25,000	50	—	Do.	2,500	4 00	....	....	
7	1859	Plattsburg	N. Y.	16,000	50	—	January & July.	5,000	7 00	....	....	
8	1858	Plymouth	Mass.	40,000	100	—	April & October.	8,000	4 00	....	....	
9	1860	Port Chester	N. Y.	50,000	50	—	Do.	4,000	4 00	....	....	
310	1860	Port Jervis	N. Y.	20,000	100	—	Do.	3,000	4 10	....	....	
11	1849	Portland	Me.	300,000	50	4	January & July.	30,000	3 00	....	....	
12	1859	Portland	Oreg.	50,000	50	—	Do.	3,500	8 00	....	....	
1	1859	Port Lavacca	Texas.	50,000	100	—	Do.	2,500	7 00	....	....	
14	1851	Portsmouth	N. H.	70,000	100	8	April & October.	6,500	3 70	....	....	
15	1855	Portsmouth	O.	50,000	50	4	January & July.	10,000	3 50	....	....	
16	1855	Portsmouth	Va.	100,000	50	4	Do.	4,000	4 00	....	....	
17	1856	Pottstown	Pa.	20,000	50	3	Do.	3,500	4 00	....	....	
18	1850	Pottsville	Pa.	110,000	50	2	Do.	10,000	3 50	....	....	
19	1850	Poughkeepsie	N. Y.	84,000	25	4	March & September.	15,000	3 50	120	110	
320	1848	Providence	R. I.	1,000,000	50	4	January & July.	60,000	3 00	122	....	
21	1858	Quincy	Ill.	300,000	50	4	June & December.	12,000	3 50	....	....	
22		Quincy	Mass.	00,000	00	—	Do.	00,000	0 00	....	....	
23	1855	Racine	Wis.	43,500	26	—	Do.	7,000	3 50	....	....	
24	1857	Rahway	N. J.	50,000	20	—	January & July.	5,000	4 00	....	....	
25	1858	Raleigh	N. C.	25,000	100	6	May & Novrmber.	5,000	6 00	....	....	
26	1848	Reading	Pa.	100,000	25	4	January & July.	25,000	3 00	....	....	
27	1851	Richmond	Va.	341.975	—	—	City Works.	30,000	3 00	....	....	Jeff. Davis has extinguished the gas-lights of Richmond, Va.
28	1859	Richmond	Mass.	40,000	25	—	January & July.	3,000	4 00	....	....	
29	1859	Ripley	O.	30,000	50	—	Do.	2,000	4 50	....	....	
330	1852	Rochester	N. Y.	200,000	50	5	Do.	50,000	2 50	....	....	
31	1857	Rockford	Ill.	40,000	50	—	Do.	4,000	4 00	....	....	
32	1854	Rock Island	Ill.	100,000	50	—	Do.	6,000	4 50	....	....	
33	1854	Rockland	Me.	50,000	100	—	Do.	6,000	4 40	....	....	
34	1852	Rome	N. Y.	85,000	100	3½	Do.	10,000	3 60	....	....	
35	1854	Rondout and Kingston	N. Y.	65,150	20	3½	June & December.	10,000	3 80	....	....	
36	1854	Roxbury	Mass.	150,000	100	5	January & July.	20,000	3 50	....	....	
37	1859	Rutland	Vt.	20,000	25	—	Do.	4,000	3 50	....	....	
38		Saco	Me.	71,600	100	3½	April & October.	8,000	4 00	....	....	
39	1857	Sacramento	Cal.	500,000	100	—	Do.	40,000	10 00	....	....	
340	1859	Sag Harbor	N. Y.	20,000	—	—	Do.	4,000	4 00	....	....	
41	1858	Saint Albans	Vt.	15,000	20	—	Do.	3,000	7 00	....	....	
42		Saint Johnsbury	Vt.	30,000	25	—	Do.	4,800	4 00	....	....	
43	1857	Saint Joseph	Mo.	50,000	100	5	January & July.	6,000	5 00	....	....	
44	1859	Saint Louis	Mo.	600,000	50	—	June & December.	180,000	3 50	....	....	
45	1857	Saint Paul	Min.	200,000	50	3	January & July.	10,000	6 00	....	....	Surplus $10,000, May 15, 1863.
46	1856	Salem	N. J.	30,000	25	3	Do.	5,000	3 86	....	....	
47	1850	Salem	Mass.	200,000	100	4	February & August.	30,000	3 24	....	....	
48	1859	Salem	O.	25,000	20	—	Do.	3,000	3 00	....	....	
49	1859	Salisbury	N. C.	14,600	50	6	May & November.	3,500	6 00	....	....	
350		Salisbury Mills	Mass.	1,250	25	—	Do.	3,000	4 00	....	....	
51		Salmon Falls	Me.	25,000	100	—	Do.	3,000	4 00	....	....	
52		San Antonio	Texas.	75,000	20	—	Do.	40,000	6 00	....	....	
53		San Diego	Cal.	30,000	50	—	Do.	10,000	10 00	....	....	
54	1854	Sandusky	O.	75,000	50	—	April & October.	9,000	3 00	....	....	
55	1859	Sandwich	Mass.	10,000	—	—	Private Works.	2,000	3 50	....	....	
56	1852	San Francisco	Cal.	1,000,000	100	6	Do.	50,000	8 00	110	....	
57	1858	Saratoga Springs	N. Y.	39,000	100	—	January & July.	6,000	3 60	70	....	
58		Saugerties	N. Y.	30,000	20	—	Do.	4,000	3 00	....	....	
59	1849	Savannah	Ga.	200,000	25	5	Do.	10,000	3 75	....	....	
360	1851	Schenectady	N. Y.	50,000	—	—	Private Works.	11,000	4 00	....	....	
61	1858	Scranton, Gas and Water.	Pa.	100,000	25	—	January & July.	6,000	3 80	....	....	About trying Water-Gas.
62	1857	Selma	Ala.	20,000	100	—	Do.	2,000	5 00	....	....	
63	1856	Seneca Falls and Waterloo	N. Y.	80,000	50	3	Do.	10,000	4 00	100	....	
64		Shreveport	La.	40,000	25	—	Do.	3,000	0 50	....	....	
65	1856	Sing Sing	N. Y.	40,000	100	—	Do.	3,000	4 00	....	....	
66		Smyrna	Del.						4 00	....	....	Petroleum Gas.
67	1860	South Adams	Mass.	10,000	25	—	Do.	3,000	4 00	....	....	
68	1859	South Bridge	Mass.	5,000	25	—	Do.	4,010	6 00	....	....	
69		South Boston	Mass.	200,000	50	—	Do.	60,000	3 25	110	....	
370		Springfield	O.	200,000	100	—	Do	20,000	3 50	....	....	
71	1854	Springfield	Ill.	75,000	50	—	January & July.	10,000	3 50	....	....	
72	1848	Springfield	Mass.	100,000	500	5	February & August.	10,000	3 60	140	....	
73	1855	Stamford	Ct.	6,250	25	5	April & October.	3,000	3 50	....	....	
74	1857	Staten Island	N. Y.	150,000	50	3	January & July.	26,000	4 00	95	....	

GAS-LIGHT COMPANIES IN THE UNITED STATES.—Continued.

Compiled from official sources expressly for the AMERICAN GAS-LIGHT JOURNAL.

CORRECTED BY JOHN B. MURRAY, No. 39 NASSAU STREET, NEW YORK, DEALER IN GAS-LIGHT SHARES.

No.	Chartered.	Town.	State.	Chartered Capital.	Par Val. per Sh. $	Semi-Ann'l Div'd.	Dividends Payable.	Population of Gas District.	Price per 1000 Feet.	Asked pr. cent.	Offered pr. cent.	REMARKS.
375	1859	Staunton	Va.	18,000	50	6	January & July.	4,000	7 00	....	....	
76		Steubenville	O.	150,000	100	—	Do.	15,000	4 00	....	....	
77		Stockton	Cal.	50,000	—	—	Do.	8,000	10 00	....	....	
78	1848	Syracuse	N. Y.	125,000	25	5	March & September.	25,000	3 00	112	....	
79		Tamaqua	Pa.	40,000	25	—	Do.	3,000	4 00	...	....	
380	1859	Tarrytown and Irvington	N. Y.	70,000	50	—	January & July.	3,000	4 00	....	....	
81	1853	Taunton	Mass.	100,000	50	4	Do.	10,000	4 00	....	....	
82		Terre Haute	Ind.	100,000	100	—	Do.	3,000	4 00	....	....	
83		Thompsonville	Ct.	25,000	50	—	Do.	4,000	4 00	....	....	
84		Tiffin	O.	25,000	20	—	Do.	4,000	4 00	....	....	
85	1853	Toledo	O.	100,000	50	3	Do.	8,000	3 50	....	....	
86	1847	Trenton	N. J.	100,000	20	4	Do.	15,000	3 60	....	110	
87	1848	Troy	N. Y.	200,000	100	4	June & December.	35,000	3 60	160	....	
88	1856	Urbana	O.	30,000	25	—	April & October.	3,500	4 00	....	....	
89	1849	Utica	N. Y.	80,000	100	4	Do.	22,000	3 60	....	....	
390	1853	Vicksburg	Miss.	66,000	50	—	March & September.	4,000	4 50	....	....	
91	1859	Vincennes	Ind.	25,000	100	—	January & July.	2,000	4 00	....	....	
92	1858	Walden	N. Y.	2,500	—	—	Private Works.	1,000	6 00	....	....	
93	1853	Waltham	Mass.	100,000	100	4	January & July.	3,000	4 00	....	....	
94	1857	Ware	Mass.	30,000	20	—	Do.	3,500	4 00	....	....	
95	1861	Warren	O.	30,000	50	—	Do.	4,000	3 00	....	....	
96	1854	Warren	R. I.	20,000	25	—	Do.	3,000	4 00	....	....	
97	1855	Washington	D. C.	500,000	20	5	Do.	50,000	3 25	150	148	
98	1859	Washington	N. C.	15,000	100	—	April & October.	1,500	6 00	....	....	
99	1848	Washington	Pa.	20,000	25	4	January & July.	4,000	3 00	....	....	
400	1854	Waterbury	Ct.	100,000	25	—	Do.	4,000	4 00	....	....	
1	1852	Waterford	N. Y.	12,000	25	—	Do.	4,000	4 00	....	....	
2	1852	Watertown	N. Y.	20,000	100	—	Do.	10,000	7 00	....	....	
3	1856	Watertown	Wis.	25,000	100	—	Do.	5,000	5 00	....	....	
4	1858	Wautoma	Wis.	30,000	50	—	Do.	3,000	4 50	....	....	
5	1857	Waverly	Miss.	20,000	100	—	April & October.	4,000	5 00	....	....	
6	1854	West Cambridge	Mass.	60,000	100	—	February & August.	10,000	4 00	....	....	
7	1852	Westchester	Pa.	100,000	25	2½	Do.	3,500	3 50	....	....	
8		Westfield	Mass.	25,000	100	6	Do.	4,000	4 00	....	....	
9		Weston	O.	20,000	25	—	Do.		5 00	....	....	
410	1857	West Point	N. Y.	50,000	—	—	United States Military	Academy.	2 00	....	....	
11	1853	West Troy	N. Y.	100,000	50	3	January & July.	10,000	3 60	85	....	
12	1850	Wheeling	Va.	75,000	25	6	Do.	12,000	2 70	....	....	
13		White Plains	N. Y.	20,000	20	—	Do.			....	....	
14	1856	Wilkesbarre	Pa.	50,000	50	—	May & November.	4,000	3 33	100	80	
15	1850	Williamsburg	N. Y.	1,000,000	50	5	January & July.	60,000	3 00	....	....	
16	1858	Williamsburg	Va.	30,000	25	—	Do.	3,000	4 00	....	....	Camp-fires of the Union Army light up this place at present.
17	1857	Williamsport	Pa.	70,000	25	4	Do.	3,500	3 80	....	....	
18	1859	Willimantic	Ct.	12,000	—	—	Do.	2,500	3 50	....	....	
19	1858	Wilmington	N. C.	60,000	50	5	Do.	8,000	5 00	....	....	
420	1852	Wilmington	Del.	200,000	50	5	February & August.	20,000	3 00	....	....	
21	1854	Winchester	Va.	86,000	50	6	January & July.	5,000	4 00	....	....	
22		Woburn	Mass.	20,000	—	—	Do.	3,000	4 00	....	....	
23	1856	Woodstock	Vt.	10,000	50	4	Do.	4,000	6 00	....	....	
24	1853	Woonsocket	R. I.	82,600	100	4	April & October.	4,000	3 50	....	....	
25	1856	Wooster	O.	25,000	50	—	January & July.	6,000	3 00	....	....	
26	1849	Worcester	Mass.	160,000	100	5	Do.	15,000	3 50	....	....	
27	1855	Xenia	O.	40,000	50	—	Do.	3,000	4 00	....	....	
28	1854	Yonkers	N. Y.	75,000	50	3½	Do.	6,500	4 00	102½	....	
29	1849	York	Pa.	40,000	57	3	[June & December.]	10,000	3 50	....	....	
430		Yorkville	S. C.	20,000	25	—	Do.	4,000	4 00	....	....	
31	1858	Ypsilanti	Mich.	20,000	50	5	February & August.	6,000	4 00	....	....	
32	1850	Yreka	Cal.	30,000	100	—	Do.	2,000	10 00	....	....	
33	1848	Zanesville	O.	44,600	25	4	Do.	10,000	3 50	....	....	

GAS-LIGHT COMPANIES IN THE BRITISH PROVINCES OF NORTH AMERICA.

No.	Chartered.	Town.	Province	Chartered Capital.	Par Val. per Sh. $	Semi-An'l Div'd.	Dividends Payable.	Population of Gas District.	Price per 1000 Feet.	Asked pr. cent.	Offered pr. cent.	REMARKS.
1	1854	Belleville	C. W.	33,040	100	4	January & July.	1,200	5 00	....	....	
2	1854	Brantford	C. W.	32,000	100	2½	Do.			....	....	
3		Brockville	C. W.	50,000	—	—	Do.	5,000	4 00	....	....	
4		Chatham	N. B.	50,000	—	—				....	....	
5	1854	Charlotte Town	P. E. I.	50,000	100	5	Do.	3,000	3 50	....	....	
6	1857	Cobourg	C. W.	30,000	—	—	February & August.	4,000		....	....	
7		Dundas	C. W.	30,000	—	—	Do.	6,000	4 00	....	....	
8		Frederick	N. B.	50,000	—	—	Do.			....	....	
9	1843	Halifax	N. S.	160,000	40	7	May.	30,000	3 00	....	....	
10	1850	Hamilton	C. W.	125,000	40	5	March & September.	20,000	3 50	....	....	
11	1848	Kingston	C. W.	80,000	100	—	Do.	6,000	3 50	....	....	
12	1853	London	C. W.	100,000	20	5	May & November.	5,000	5 00	....	....	
13	1847	Montreal	C. E.	400,000	40	—	March & September.	110,000	2 80	....	118	Last sale at this figure.
14	1854	Ottawa	C. W.	40,000	40	5	Do.	5,000	4 50	....	....	
15	1859	Point Levi	C. E.	25,000	25	—	January & July.	4,000	3 50	....	....	
16	1859	Port Hope	C. W.	28,000	20	4	May & November.	4,500	3 50	....	....	
17	1847	Quebec	C. E.	200,000	200	4	January & July.	60,000	3 00	....	....	
18	1848	Saint Catherine's	C. W.	80,000	20	—	May & November.	7,000	4 50	....	....	
19	1859	Saint Hyacinthe	C. E.	15 000	20	—	Do.	4,000	4 00	....	....	
20		Saint John	N. B.	170,000	85	—	June & December.	25,000	3 50	110	110	Sales at this figure.
21		Saint John's	N. F.	50,000	—	4	Do.	30,000		....	....	
22	1858	Sorel	C. E.	14,000	20	4	Do.	4,000	3 00	....	....	
23	1848	Toronto	C. W.	400,000	100	4	February & August.	50,000	3 33½	....	....	

GAS-LIGHT COMPANIES IN CUBA, MEXICO, SOUTH AMERICA AND NEW ZEALAND.

No.	Chartered.	Town.	State.	Chartered Capital.	Par Val. per Sh. $	Semi-An'l Div'd.	Dividends Payable.	Population of Gas District.	Price per 1000 Feet.	Asked pr. cent.	Offered pr. cent.	REMARKS.
1		Callao	Chile.		—	—	January & July.	20,000	7 00	....	....	
2		Cardenas	Cuba.	50,000	—	—	Do.	180,000	5 00	....	....	
3	1857	Compania Cubana	Hav'a	500,000	500	10	Do.			....	....	
4		Cienfuegos	Cuba.		—	—	Do.	12,000	5 00	....	....	These four towns are lighted by the Compania Cubana of Havana.
5		Guanabacoa	Cuba.		—	—	Do.	14,000	5 50	....	....	
6		Regla	Cuba.		—	—	Do.	10,000	5 00	....	....	
7		Trinidad	Cuba.		—	—	Do.	16,000	5 00	....	....	
8		Guyaquil	S. A.	150,000	—	—	Do.	35,000		....	....	
9		Havana	Cuba.	1,250,000	500	7½	Do.	200,000	5 00	....	....	
10		Lima	Peru.	100,000	—	—	Do.	150,000		....	....	
11		Maranham (Chartered)			—	—	Do.			....	....	
12		Matanzas	Cuba.	50,000	—	—	Do.	180,000	8 50	....	....	
13		Mexico City	Mex.	550,000	—	—	Do.			....	....	
14		Montevideo	S. A.	500,000	—	—	Do.			....	....	
15		Para (Chartered)			—	—	Do.			....	....	
16	1854	Rio de Janeiro	S. A.	1,200,000	500	7½	Do.	300,000	4 00	....	....	
17		San Iago	Chile.	500,000	—	—	Do.	180,000	7 00	....	....	
18	1857	Saint Jago de Cuba	Cuba.	450,000	500	—	Do.	25,000	5 00	....	....	
19		Valparaiso	Chile.	500,000	—	—	Do.	85,000	6 00	....	....	
20		Vera Cruz	Mex.	500,000	—	—	Do.			....	....	
21		Ville Clara	Cuba.	50,000	—	—	Do.			....	....	
22		Auckland	N. Z.		—	—				....	....	

THE CHEMICAL PROGRESS OF GAS MANUFACTURE SINCE 1841.

BY JOHN LEIGH, ESQ., M. R. C. S., &C.*

My appointment as the scientific officer of the Manchester Gas Committee commenced or took place about the latter end of the year 1841, for the notes of my experiments at No. 5 station (now No. 1 station), bear date the beginning of the year 1842.

My attention was in the first instance directed by Mr. Wroe (then the comptroller) to the naphtha manufacture. The naphtha, at that time largely manufactured from the coal-tar produced at the station by the committee, Mr. Wroe informed me, was very much complained of, and was produced only in small quantity, viz., not more than 3 *per cent. from the tar*. The naphtha did not evaporate rapidly enough, and left a dry, disagreeably-smelling residuum; and he wished me, as my first duty, to experiment upon it and endeavor to improve the manufacture, as Messrs. Birley, the only customers of the committee for this article, had given notice to discontinue the purchase of it unless it were improved.

I called on Messrs. Birley, whose foreman showed me that the specific gravity of the naphtha was too high—that it did not possess sufficient volatility, consequently did not leave the cloth fast enough, and left a dry, offensive powder on the latter. This powder I examined, and found to be naphthaline. I then examined the mode of manufacture pursued at No. 5 station, where the naphtha was mostly made. The tar was put into a large still of iron, either alone or with a small quantity of water, and distilled. The oil which passed over, and was called naphtha, was put into a leaden trough with a quantity of sulphuric acid or oil of vitriol, and a large quantity of water immediately added. The mixture was then gently agitated for about twenty minutes; a quantity of lime was then thrown into the mixture, the whole again agitated, the supernatant liquor then drawn off, and distilled with water or steam, and the product was rectified naphtha.

In order to ascertain the maximum quantity of naphtha that tar would yield, I distilled one gallon of tar from a small iron still, and obtained, first, 8 fluid ounces of crude naphtha of specific gravity 0.884. On further distillation, I obtained 4 fluid ounces more of specific gravity 0.924. The 12 fluid ounces, distilled again from a glass retort, yielded 8 fluid ounces rectified naphtha, specific gravity 0.879. This is at the rate of 7¼ per cent. crude naphtha and 5 per cent. rectified naphtha from the tar. I observed that the bulk of the naphthaline was contained in the heavier portions of the crude naphtha, and that when the sulphuric acid was agitated with this, a greater quantity was required to combine with the naphthaline and associated substances dissolved in the naphtha, than when the light oils were separated in the first instance, and then treated separately by the acid. I also observed that the immediate addition of water to the crude naphtha and sulphuric acid very much prevented the action of the latter, so that very little naphthaline was removed by it. The addition of the lime also to the mixed acid and crude naphtha caused the separation of much offensive matter from the acid, which was redissolved by the naphtha, and contaminated it.

In January, 1842, I commenced operations on naphtha manufacture on a large scale, by distilling, at No. 5 station, 1,300 gallons of tar, and completing the operations in the way heretofore practised. The tar was distilled only once, or rather the crude naphtha. I obtained by this method only 3½ per cent. of naphtha from the tar. I next distilled the tar with a large quantity of water, continuing the distillation till the crude naphtha had a specific gravity, when stirred together, of 0.913. This crude naphtha was again distilled with water, by which much naphthaline was separated and left behind in the boiler. The crude naphtha of the second distillation was then mixed with sulphuric acid, and agitated thoroughly, no water being added. The naphtha was then drawn off, after the red and thickened sulphuric acid had subsided, a little lime added to the naphtha, and the latter distilled. The naphtha obtained was equal to 4.6 per cent. from the tar, of great purity and volatility, and perfectly satisfactory to Messrs. Birley.

* Report to the Manchester Gas Committee.

The improvements in the manufacture consisted in the double distillation before treatment with sulphuric acid (the first distillation being carried to a greater extent than formerly), the removal of much of the naphthaline by the second distillation, the saving thereby of sulphuric acid—the more complete purification of the naphtha by this and by the the omission of water in the mixture—the production of a more volatile naphtha, having scarcely any dissolved naphthaline, and an increased yield of naphtha 4.6 per cent. from the tar.

In the course of my experiments on naphtha, I found that this was a very mixed fluid, made up of oils having different specific gravities—different boiling points and rates of volatility, the two latter having no definite relation to the former; and that very volatile naphtha could be produced of rather high specific gravity, so that a still larger yield from the tar would be obtained; and that the naphtha could be fractioned by distillation into several distinct oils, the properties of which I examined.

Having fractioned the oils of naphtha by distillation, I next examined their special properties, and particularly examined the action of acids upon them. My Note-book I., No. 8, page 29 and *seq.*, records details of experiments in 1841–42, on the action of acetic, muriatic, sulphuric, nitro-muriatic, sulpho-muriatic, and more importantly of nitric and of mixed nitric and sulphuric acids, on naphtha. These experiments show how much naphtha and similar oils may be improved in fragrance and general qualities.

The results of the third experiment detailed in my Note-book I., No. 8, page 32, have actually been patented within the last few weeks by other parties.

The lightest oil that I obtained from naphtha I made the subject of special experiment, treating it alternately with sulphuric acid and caustic soda, till no farther discoloration was produced. I then endeavored to combine it with hyponitric acid or peroxide of nitrogen, which I sought to obtain readily and easily by dehydrating ordinary commercial nitric acid by sulphuric acid. I mixed three parts by measure of sulphuric acid with one part of nitric acid, and added the light and pure naphtha to it by degrees, keeping the mixture cool. A violent reaction took place, and a strong smell of oil of bitter almonds was developed. On pouring the mixture into cold water a deep yellow heavy oil fell to the bottom, having the smell of oil of bitter almonds. This I found to be identical in its properties with the nitro-benzole of Mitcherlich, and which that illustrious chemist had prepared by acting with fuming nitric acid on a liquid obtained by distilling a mixture of flowers of benzoin or benzoic acid with lime. I then tried the action of fuming nitric acid on naphtha, with the same result.

I was thus the first to prove that coal-tar contains *benzole*. By allowing a large quantity of light and pure naphtha to stand together with the mixed nitric and sulphuric acids for a few weeks in a large carboy at No. 5 station, I obtained a mass of beautiful crystals of binitrobenzone, which I exhibited, together with a bottle of the oil nitrobenzole, at the meeting of the British Association in Manchester, in 1842.

My paper, read at the Section, contained a very copious description of both these bodies, but was very much abbreviated in the volume. The discovery at the time I thought an important one, and so it has proved, as it is the source of all the beautiful colors which have been developed of late years under the names of mauves, magenta, solferina, and other colors, all of which are prepared from nitrobenzole. I thus laid the foundation of the present high price and value of coal-tar. I read papers and produced samples of the nitrobenzole at the Royal Institution, Manchester, and at Mr. Sturgeon's Gallery of Science; and Dr. Playfair mentioned the discovery in the Chemical Society of London. I consider that I gave sufficient publicity to establish my priority of discovery. At the next meeting of the British Association at York, in 1843, the analysis of the substances were communicated by Dr. Smith, in my name, as I was not present.

AMMONIA WATER AND SAL-AMMONIAC MANUFACTURE.

The naphtha manufacture having been brought into satisfactory condition, my attention was next directed by Mr. Wroe to that of sal-ammoniac, which, in 1841 and subsequent years, was extensively carried on at No. 2 station. I found that the salt was prepared by saturating gas-water with muriatic acid, evaporating the resulting liquid in iron pans, draining the crystallized salt, drying it on a stove, and subliming it into large cakes from iron pots into lead domes. In this operation a large quantity of gaseous matter was given off on the addition of the acid to the ammonia water, the smell of which constituted a great nuisance to the neighborhood.

I made an analysis, or rather many analyses of the gas-water, and obtained from an imperial gallon:

Sulphur	224 grains.
Carbonic acid	1,600 "
Cyanogen	8 "

These three substances were in combination with ammonia, forming hydrosulphate, carbonate, and prussiate of ammonia. In addition to these, there was always a quantity of muriate of ammonia, varying in amount from 2 ounces to 4½ ounces per gallon. Thus, there would be six ounces of carbonate of ammonia in 1 gallon of gas-water to about 1 ounce of hydrosulphate and about 13 grains of prussiate. As the chief salt thus was carbonate of ammonia, the acid of which is easily precipitated, I made a number of experiments with different precipitants; amongst others, I found that 10 ounces of muriate of lime sufficed to decompose the carbonate of ammonia in 1 gallon of gas-water. I endeavored to get this salt from the residuum of the brine springs in Cheshire, but could not induce the manufacturers to evaporate their mother liquor for it; subsequently, it was found to be obtainable from Newcastle-on-Tyne in any desirable quantity. I set about the use of it therefore at once, after having brought the matter before the committee.

Finding that the quantity of tarry matter in the gas-water was very injurious to the sal-ammoniac produced in the ordinary way, volatilizing with it in the sublimation, and imparting a yellow greasy stain to the sublimed salt, I fitted up a distillatory apparatus, consisting of a large boiler, having a still-head, the beak of which dipped into a receiving vessel, closed except at its junction by a pipe and rose with another receiver, into which the pipe and rose also dipped. When a third part of the liquor had distilled over, the whole of the volatile salts of ammonia had passed, leaving behind the tarry matter and two-thirds of the water, which were run off; considerable evaporation was thus saved. The object of the dip-pipes and roses was to cause the carbonic acid, which was largely liberated in the distillation, to pass again through the distilled solution of ammonia, by which it became recondensed and absorbed. Practically, this distillation and mode of condensation were valuable, as a very concentrated and clear colorless solution was obtained, well saturated with carbonic acid, and easily decomposable by muriate of lime. The decomposition was effected by running the liquor into large wooden vats, and pouring in the muriate of lime dissolved in hot water. Dense crystalline carbonate of lime subsided, and muriate of ammonia remained in solution, which was evaporated to dryness and sublimed in the ordinary way.

The saving effected by the substitution of muriate of lime for muriatic acid, together with the improved economy of working and better quality of sal-ammoniac produced, was about £600 in the first year, and a large amount in subsequent years, as the manufacture increased.

During this time proposals were made to the committee to manufacture oil of vitriol and Prussian blue from the gas-water, and they were urged to put up vitriol-chambers and other costly apparatus.

I showed the committee, by careful analyses, that the sulphur contained in a whole production of gas-water amounted only to 3 tons 17 cwt. and 76 lbs., and that the Prussian blue produced in a year would be 2 tons 13 cwt.

THE GAS.

Coming next to the gas itself, I found that the method of purification adopted threw a pressure on the retorts equal to a column of water varying from 26 to 30 inches. The method of purification was this: On leaving the retorts, the gas was passed through a series of cells or chambers, in some cases cooled above by a layer of water, in others (as at No. 5 station), traversed by a series of tubes, open at each end, so as to allow the passage through them of a current of air; the sole object of this apparatus being to cool the gas, so that a

considerable quantity of the tar and water suspended in the gas might be deposited. The gas was next passed by a series of dippers through two or three vessels or cisterns of water, and thence into wet lime purifiers, from which it proceeded to the holders. The cisterns were filled with common water, and were emptied and refilled about every six weeks; they contained only a few hundred gallons, and, at the end of the time the water was allowed to remain, it had scarcely a higher specific gravity than ordinary gas-water.

As it was obvious that the washing of the gas by pipes dipping into water for the separation of the ammonia was that part of the process which threw the most pressure on the gas, this was first submitted to investigation and sought to be improved. A very little examination sufficed to show that this method of washing, though in general use, not only injured the gas by the pressure and consequent retention of the gas in the retorts, but almost entirely failed in the accomplishment of the object for which it was adopted (the separation of the ammonia), the injurious action of the latter still continuing, together with the loss of the large quantity of ammonia contained in the gas, and which might be made available in the manufacture of the salts of ammonia carried on at the works. An observation of the passage of gas delivered by tubes through fluids contained in glass vessels showed that such gas passed through the liquids in globular volumes, the circumference or external part of which alone came into contact with the liquid, and could alone be washed by the latter or have anything removed from it; and, however this was varied in accomplishment, whether by simply carrying the gas through the liquid, or by rolling the volumes of gas along the surface, as practised at some works, the result was still the same—the outward layer of gas only was or could be touched, the great bulk passing along unwashed, and retaining all its impurities. To place the matter beyond doubt, I passed 1,000 feet of gas through a series of vessels containing sulphuric acid, conducting the operation very slowly, and I obtained a quantity of sulphate of ammonia, equivalent to from 6 ounces to 9 ounces of sal-ammoniac, the quantity varying between these two extremes according to the coal or cannel used. It was thus proved that the globular system of washing was utterly inefficacious for the removal of impurities.

To improve this, I tried the effect of dividing the gas into an immense number of streamlets, and exposing these to the action of a large surface of liquid by means of what are called roses (perforated plates); but these required a dip, and the gas, as it issued through the perforations, coalesced and formed volumes, and was imperfectly washed. (The rose system did not answer.) I had then an apparatus constructed, consisting of a long, deep vessel with glass sides, so as to enable the process to be seen; this was supplied with perforated shelves, or rather shelves of wire-work, on which were placed layers of straw, ling, birch, and other open substances. The gas entered the apparatus at the bottom, and a shower of water fell from the top on to the first layer, and so in successive showers to the bottom, the gas in its ascent becoming divided, passing through the showers and over the great surface exposed by the dividing material. By this means, the salts of ammonia were almost entirely removed from the gas.

I had subsequently a larger apparatus fitted up on the same principle at No. 5 station, near the old gateway, and passed through it the gas from several hundred weight of cannel, with a perfect separation of the salts of ammonia. The apparatus was subsequently extended at No. 5 station, and was till very lately at work by the river-side. It is now superseded by the splendid washers recently erected.

Believing that all the ammonia in gas existed in the condition of salts of ammonia, and, therefore, perfectly soluble in water, and never as free or caustic, and, therefore, gaseous ammonia, but in combination with the acid impurities, as carbonic acid, prussic acid, and sulphuretted hydrogen—in other words, that there was always in the gas an excess of the acid impurities more than sufficient to neutralize the ammonia—I passed a measured quantity of unpurified and unwashed gas very slowly through a series of bulb tubes containing pure distilled water, and afterwards through barytes water, then through a potash solution of arsenic, and lastly through dilute muriatic acid.

The pure water I found dissolved out the salts of ammonia, the muriatic acid scarcely forming any sal-ammoniac from the washed gas. The arsenical solution, on the other hand, showed abundance of free sulphuretted hydrogen, and the barytes water of carbonic acid.

The amount of these was very considerable, as was ascertained by numerous analyses.

It was thus proved that I had simply salts of ammonia to deal with, soluble in liquids, and no gaseous ammonia. The importance of removing these salts of ammonia from the gas before proceeding to any further purification was obvious, as the lime employed in the purification, by combining with the acids of the ammonia, liberated free gaseous ammonia, which went forward with the gas, to the great injury of all metallic work where the gas was burned. Any mere aqueous solutions of absorbents, or, indeed, simple water itself in sufficient quantity, could not be employed, as they would absorb olefiant gas and the other illuminating hydrocarbons at the same time as the ammonia, and so impoverish the gas.

It occurred to me that the gas-water, or ammonia-water itself, though not saturated with ammonia salts, might yet be saturated with olefiant and the other illuminating gases, as it is produced at the same time as, and in contact with, the latter. The solvent power of water over ammonia salts is very great, whilst it only takes up an eighth of its own volume of olefiant gas. I, therefore, passed through bulb tubes filled with ammonia-water a measured quantity of gas—analyzing the gas before and after its passage through—and found that there had been no absorption of olefiant gas by the ammonia-water, although it readily took up the ammonia salts, and had its specific gravity nearly doubled.

After these experiments (and in completion of the testing of the efficacy of ammonia-water in removing ammonia salts from gas, I may mention that I passed 1,000 feet of gas, after it had been washed through sulphuric acid, and obtained little more than a quarter of an ounce of sulphate of ammonia), I constantly urged Mr. Cleminshaw to adopt the system of washing the gas by ammonia-water in tall shower-vessels, and so relieve the retorts from pressure, and get the increased value of the ammonia-water as well as a purer gas. I drew him plans of washers, such as are now in use; yet very long delay took place. At length they were erected, and the gas thoroughly washed, leaving only such an amount of ammonia salts in suspension as its great velocity enabled it to carry forward, and of which a little copperas deprived it.

The general result was, that the ammonia in the gas was reduced to an average quantity corresponding to about 40 grains of sal-ammoniac in 1,000 feet of the gas.

(To be concluded.)

Tin-lined Lead-Pipes.—It has been frequently proposed to line lead-pipes and cisterns with tin, in order to prevent the oxidation of the lead and the contamination of water. This proposal has recently received an emphatic rebuke by the Liverpool Chemists' Association at one of their late meetings, at which specimens of lead-pipe and sheet-lead, electro-plated with tin, were exhibited, and some discussion ensued respecting the use of lead coated in this manner for water-cisterns and pipes. It appeared to be the opinion of the meeting that the coating of tin, instead of preserving the lead, was far more likely to ensure its more rapid corrosion; for, if the coating of tin by any means happened to be scratched off, even to the slightest extent, galvanic action would take place, and the lead would be destroyed very quickly. Dr. Nevins and Dr. Edwards stated that their experiments had proved that such would undoubtedly be the case; Dr. Edwards remarking, that in one case which he had examined, a cistern made of lead, in which was an accidental admixture of tin, was eaten out by well-water in six months, the lead being rapidly precipitated in the form of sulphate.

Street Lamps of Chicago.—Under the provisions of the new charter of the city of Chicago, Ill., lamps erected in new districts, will hereafter be paid for by special assessment on the lots along the streets to be lighted.

New Theory of the Generation of Steam.—At a recent meeting of the Liverpool Literary and Philosophical Society, Mr. E. J. Reed read a paper upon the New Theory of the Generation of Steam, discovered by our old and esteemed correspondent, Mr. Charles Wye Williams, and demonstrated in Mr. Williams's last work "On Heat in its relation to Water and Steam," (just published by Longman & Co.) The object of the paper was to show that the first effect of applying artificial heat to water is not to heat the water, as such, but to convert a certain portion of it into vapor. Mr. Williams first drew attention to the fact that the rise of the generated vapor, and its diffusion through the liquid was plainly visible to the eye, a discovery which seemed to have escaped all previous experimenters, and to have been reserved as a great reward for the scientific ardor and research of Mr. Williams. At this point of the paper Dr. Edwards, the analytical chemist of Liverpool, exhibited a beautiful experiment illustrative of this discovery, by means of an electric light. On heat being applied to a glass vessel containing cold water, instead of the series of ascending and descending currents described by all previous writers, a continuous movement *upwards* of cloud-like vapor was made visible to the audience. After explaining this discovery at length, and demonstrating that the movements made visible were those of vapor and not of heated currents of water, the author drew several important inferences from the phenomena, such as that it is untrue to say, as many authors do, that vapor is formed at the *surface* of water only; that water, even when of a low temperature does not *condense* vapor—*i. e.*, reconvert it into water; that water is capable of containing, and, when what is called warm or hot, does contain uncondensed vapor or steam. It was urged that Mr. Williams's discovery rendered a revision of the common theory urgently necessary. An interesting discussion followed the reading of the paper, and the usual complimentary vote, and a vote of thanks to Mr. C. Wye Williams, who was present, terminated the proceedings.—*London Mining Journal.*

New Use for Coal-Tar.—M. A. F. Mennons, of Paris, France, has recently patented a method of preparing coprolites and other phosphatic minerals for manures, in which process coal-tar performs an important part. The following is abridged from the specification of M. Mennons:

This invention relates to an improved method of treating coprolites and other calcareous phosphates, by means of which these minerals are converted into a more soluble and consequently more highly assimilable manure, and, at the same time, are made capable of disinfecting certain animal products, and of extracting therefrom the greater part of their fertilizing principles. The nodules of mineral phosphates to be operated upon are first pulverized as finely as possible by grinding, and with the powder so obtained is intimately incorporated from six to ten per cent. of organic matter highly charged with carbon and hydrogen, such, for instance, as the gas-tar or pitch produced in the distillation of coal. The mixture is then calcined at a temperature between 400° and 500° centigrade (752° and 932° Fahrenheit) in closed retorts containing charges of about four hundred weight each. By the decomposition of the tarry matter, abundance of gas containing sulphuretted hydrogen is evolved, which should be let into the furnace and there consumed. The carbon and hydrogen reduce partially the oxide of iron, opening up the structure of the mineral—a disintegrating action which is assisted likewise by the escape of carbonic acid and water from the carbonate of lime. When the disengagement of the gas terminates (usually in about an hour), the operation is concluded by withdrawing the charge and placing it in sheet-iron receptacles to cool. The product so obtained is a mixture of phosphates with small proportions of quicklime and carbon, and may either be directly employed as a manure, or enriched by an admixture of nitrogenous organic matter, such as blood, fæcal and liquid excreta, or other animal refuse, upon which substances it operates as a disinfectant.

It is stated that this process is peculiarly appropriate for the treatment of Sombrero Island guano, which is one of the richest phosphatic substances known.

THE AMERICAN GAS-LIGHT JOURNAL is published on the 1st and 15th of every month, and is the recognized official organ of

LIGHT, HEAT, WATER-SUPPLY AND SEWERAGE.

Its purpose is to ascertain and make known all new discoveries in the science and economical application of LIGHT, and promote thereby the interests of companies and consumers; to encourage and aid the introduction of PURE WATER from Lakes and Rivers into Towns and Cities, and to improve the system of SEWERAGE, VENTILATION, HEATING, and DRAINAGE everywhere.

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THE

AMERICAN GAS-LIGHT JOURNAL,

PUBLISHED ON 1ST AND 15TH OF EVERY MONTH.

C. ELTON BUCK, ... EDITOR.

WEDNESDAY, JULY 1, 1863.

With this issue the AMERICAN GAS-LIGHT JOURNAL enters upon the fifth year of its existence, the first number having been published July 1st, 1859. The recurrence of the anniversary of the inauguration of any enterprise affords a fitting occasion for recalling the events of the past, and making resolutions for the future. Yielding to the customs of an occasion so interesting, it may not be inopportune for us to take a retrospective view of our progress, and of the status of the gas-light world of America at the time of our inauguration and the present moment.

When our enterprise was announced to the world, many were the admonitions received from well-meaning friends, and the predictions of disaster from those who always look at the dark side of the picture, respecting what they were pleased to call the venture we were about to undertake. A journal to represent the gas-light interest was thought to be a very preposterous undertaking. The science and art of gas-making was very little understood outside of the immediate circle of those interested in it, and in addition to this it was vaguely hinted that the gas companies, being opposed to all attempts to give publicity to the particulars of their business, would regard us with a jealous eye, and withhold from us their support.

Four years have rolled away since that time. How have these predictions been fulfilled? We are happy to say that not one of them was ever verified. Our first number was sought for with an avidity which clearly proved that the JOURNAL filled a void which had been long felt, and the evidences of appreciation which we received from all sides, and from all parts of the world, were gratifying in the extreme. Gas-engineers not only gave us their hearty substantial support, but assisted us with their counsel, and opened freely to us their practical experience, from which we have drawn largely. The prediction that our city gas companies would regard our enterprise with disfavor was flatly contradicted by the late president of the New York Gas-Light Company, the venerable WILLIAM W. FOX, becoming our first subscriber.

Referring to the tables of gas-light companies in the United States, published in the early numbers of our first volume, we find that there were at that time less than three hundred companies in existence. Our present tables, published in another part of this number, show a total of four hundred and thirty-three companies—an increase of forty-four per cent. We by no means arrogate to ourselves the credit of effecting this increase: but we do claim that by agitating the subject of the advantages of gas over all other agents for artificial illumination, and by diffusing the rudiments of the science of gas-lighting among the people, we have contributed our mite to the cause; and it is with no small satisfaction that we dwell on the result which has been achieved, let the credit be given to whom it may.

During the last two years of our existence, the country has been upheaved by the presence of civil war with all its horrors. Feeling our mission to be one of a different nature from that of the daily press, we have refrained from discussing the military and political questions of the day. Such subjects coming within the province of other publications, we have left them to their tender mercies, and have studiously refrained from making our sheet a vehicle for criticisms upon the conduct of the war, or for proclaiming the creed of any political faction. We have endeavored to confine our attention to the specialities which we at first adopted as deserving our particular notice, and it has been our effort to elucidate them as fully as practicable.

In entering upon a new year of our existence, we extend a hearty greeting to our friends and patrons who have exhibited so many tokens of favor and appreciation. It shall be our constant effort to merit a continuance of their approval, and we hope that at each recurring anniversary of our existence, we may have the satisfaction of exchanging our greetings with all of our old friends, and as many new ones as may favor us with their encouragement.

PRIVATE GAS-WORKS.

A few years ago private gas-works in country-seats and factories were rarely met with in the United States, and the few that were in existence were frequently visited as objects of curiosity, and thought to be but little less worthy of attention than were the larger works in England, at the inauguration of gas-lighting in the early part of this century. But within the past few years quite a revolution has been made in the mode of lighting private dwellings and factories. Private gas-works have been erected all over the land, and even churches, situated in towns where no gas-works are built, are now illuminated by gas manufactured on their own premises, for their own exclusive use.

The ease and simplicity with which these small works can be managed, the many advantages attending the use of gas in preference to all other substances for artificial illumination, and the diffusion of the principles of gas-lighting, have done much to increase the number of private works. When properly constructed they take up but little room, and, when well cared for, requiring little or no repairing; they generate the requisite quantity of gas with the utmost regularity, and, from one end of the year to the other, they perform their allotted task with such evenness and uniformity as to call for no undue anxiety, nor to demand more than a few hours daily attention.

Rosin was formerly the substance generally carbonized in private gas-works; but its present high price, owing to the Southern rebellion, has placed it entirely out of the category of gas-making substances. Petróleum and petroleum tar have been used as substitutes, as well as several so-called "gas-oils," which are prepared during the distillation of crude petroleum, and which we may include under the general name of petroleum tar, as they are all essentially the same. This substance being freed from the naphthas, benzine, and the lighter hydro-carbons, by the preliminary treatment it has received, is very well adapted for carbonization, and being far less inflammable than crude petroleum, there is little or no danger to be apprehended from it. It is readily carbonized, and yields a rich gas—too rich, indeed, to be consumed in burners larger than 3-feet. The gas made from this material is readily purified, and, on the whole, it forms a very satisfactory substitute for rosin, although nothing, in our opinion, is quite equal to that substance.

We do not see why the number of private gas-works should not be indefinitely increased. The wealthy residents of our large cities who spend from four to eight months of the year at their country-seats, frequently remote from any gas-works, must surely often miss the bright and cheerful gas-light which they are accustomed to burn in their city homes. By a very small expenditure they could have erected on their premises, works of their own, capable of furnishing quite as good a light as that distributed by any corporate gas company, and which could be run at very little expense. Indeed, they would be gainers by the change in more ways than one. Their expense for other illuminating materials would cease, and the cost of running private gas-works would be far less than the money they now spend for lamps, oil, candles, &c. We feel assured that this result would be accomplished, and many gentlemen who have erected private works at their country-seats could add to our testimony from their personal experience.

TO SUBSCRIBERS.

With this number the fifth volume of the JOURNAL commences. Subscribers whose terms of subscription begin with the new volume will please remit by mail the price for the current year, $3 00.

It is our custom to discontinue sending the JOURNAL unless payment is promptly made in advance.

☞ JOHN B. MURRAY, Esq., the proprietor of this JOURNAL, sails for England to-day in the steamship *Scotia*, to travel for a few months for the benefit of his health.

Any of our English friends who may wish to communicate with Mr. MURRAY will please address him, care Messrs. BARING BROTHERS & Co., bankers, London.

REFLECTORS OF LIGHT FOR HOUSES.—In the narrow streets of Genoa a reflector is used, made of clean white cotton or linen cloth, attached to a framework of wood, or to a couple of iron rods, secured to brackets of iron, one rod being at the top and the other at the bottom of the brackets, and placed at an angle of 45 degrees with the window, the apex of the angle nearly touching the window, and, of course, turned downwards, the reflector itself being of the breadth of the window at the least, and of about three feet or more in depth. The shops on the ground floor have the reflector fixed towards the upper part of the window, in order to leave the lower part free for exposing the articles that may be for sale. A correspondent of the *Morning Advertiser* suggests the use of such reflectors in houses and in other buildings situate in the narrow streets of our towns or villages. The adoption of such a plan generally and at once would create employment for many a cotton loom now idle.—*London Builder*.

[In this city "daylight reflectors," as they are called, have long been used to increase the light of basement offices, and the rear windows of stores. They are made with a metallic surface covered with glass, or in some instances are constructed of glass, backed with an amalgam. Their use is in many locations an absolute necessity.—ED.]

GAS EXPLOSION IN ENGLAND.—The London *Builder* says that an alarming occurrence recently took place in the Royal Pavilion at Brighton. A large audience had assembled to listen to the performance of the Christy Minstrels. There was a strong escape of gas in the room, and a voice was heard from one side of the room calling that the escape was there. In a few seconds more the crack of a lucifer-match was heard, and a light was seen to be passed along the wall, about seven or eight feet from the floor. A series of explosions followed, and all was confusion; but in a few minutes all were got out. Then men set to work and extinguished the flames, which jeopardized the whole building.

FINANCIAL.

Tuesday Evening, June 30th, 1863.

The money market, during the past two weeks, has exhibited a state of activity and irregularity greater than that which has characterized it for several months. Without any apparent cause, lenders suddenly stiffened the rates at which they were willing to favor stock operators, and were particular, also, in demanding larger margins than usual, especially on shares belonging to the "fancy" denomination—such as *Harlem* Railroad and the like. Of course this had a tendency to react on the whole share market, and we have seen several spasmodic ups and downs in the general stock list, which would be otherwise inexplicable.

There has been very little doing in gas-light shares, but that little has sufficed to show that holders are so strongly convinced of the value of these shares as to be unwilling to part with them unless at full rates.

As an evidence of the value placed upon the shares of our city companies, it may be mentioned that on June 18th thirty shares of the *Manhattan* Gas Company were sold at public sale at the rate of 280 per cent.

We have noticed sales of the *Citizens'* Gas Company, of Brooklyn, N. Y., at 127 per cent., which is a slight advance. Holders of this stock are generally unwilling to part with it. We know of parcels for which 130 is asked, and an offer below this would not receive the smallest consideration.

Among the gas shares now offered for sale, in addition to those mentioned in our last issue, we notice *Lafayette*, Ind.—a very good company. The works at Lafayette were built by Wm. D. Parrish, Esq., of Philadelphia, which fact is a sufficient guarantee of the excellence of their construction. There are also some shares of *Paterson*, N. J., offering, but this stock is held at figures rather above the views of purchasers. We see no reason why this company should not be one of the most prosperous in the country.

ANSWERS TO CORRESPONDENTS.

J. M., of Bacup, England.—*We have forwarded a copy of the Index, by mail, which we hope will reach you ere this. Any missing numbers we will cheerfully supply.*

C. C., of Ohio.—*Not all of them. A few were reserved for future developments. Your hint is a good one and shall be observed.*

L. B. E., of Me.—*As you will perceive by referring to another column, your question is there answered.*

R. S. B., of Md.—*We cannot gratify your curiosity. There are secrets in all professions, and we do not see why our own should be exempt from the general law.*

J. T. S., of Pa.—*We have heard of the invention you refer to, and think it a good one. The parties having charge of it will apprise you of further particulars.*

O. G. E., of Ill.—*The last we heard of him he was in New Orleans. We suppose his sojourn there will be but temporary.*

F. C., of Mo.—*The company publish two reports every year—at the expiration of each six months. The last one we have not yet seen.*

J. J. R., of Pa.—*We thank you for your expressions of appreciation. For the future, we intend to pursue a course which will, we hope, merit a continuance of them. We are pleased to hear of the success of your enterprise. A few years ago such an undertaking would have been thought hazardous; but the success which it has achieved proves the soundness of judgment which was evinced at the start.*

Q. G. S., of N. Y.—*Your favor was received, and we thank you for the information. We have quoted the nett price of gas after July 1.*

M. S., of Pa.—*We are obliged for your attention. You will see that we have made the alteration, and quoted the nett price.*

E. F. J., of Mass.—*The amount you report is very large, and we are inclined to think some mistake has been made. Let us hear further particulars when you shall have completed your experiments. It is a very interesting subject, and one that will fully repay you for making the investigation.*

J. E., of C. W.—*You will find the address of the party in our advertising columns.*

A. B. L., of Cal.—*We hope your numbers will reach you more regularly in future There is terrible mismanagement somewhere in the Post-office department.*

C. P. W., of Md.—*The market is very unsteady, and prices fluctuate from time to time with great irregularity. The present indications are that rates will be very high for some time to come. At least, such is the opinion of heavy dealers in the article.*

J. J., of Ky.—*We have not been able to procure a copy of the work. It has been out of print for some time. We have been endeavoring to get a second-hand copy for our own use, but even that seems to be impossible A new edition is being prepared, which will not be ready for several months, perhaps a year.*

CORRESPONDENCE.

GAS FROM KEROSENE TAR AND HARD WOOD.

Albany, N. Y., June 25th, 1863.

To the Editor of the American Gas-Light Journal:

We now obtain such extraordinary results by a new method of using the kerosene tar in the Aubin Gas-Works that I inform you of it. We cut maple or other hard wood into small pieces, dry them, and then saturate them with the tar—using one gallon to 55 lb. of wood. From this we obtain 400 feet of rich gas, and the charcoal left is clean and of the best kind, and is *actually worth more than the wood used.* Other advantages of this process are, that it requires less fuel, although it makes gas much faster than our old methods, and, with a slight modification, enables us to use advantageously the cheap, thick, and lumpy tar hitherto of no value except for fuel.

As hard wood can be had, and its charcoal is saleable everywhere, the above simple method of using the Aubin Gas-Works adapts them to every locality, and in connection with the small cost of operating them, and the great simplicity of construction to which many years of experience have led, should introduce them wherever gas-works are needed. In proof of this practical value, I add that Village Gas-Light Companies selling only 300,000 feet of gas, are successfully using them.

Very truly yours,

H. Q. Hawley.

DETERMINATION OF THE ILLUMINATING POWER OF MINERAL OILS.

The true test of the actual monetary value of an illuminating oil is a subject of great practical importance. It is obvious that the relative dearness or cheapness of any two samples of oil cannot be determined by comparing their cost per gallon, but must be ascertained by measuring their illuminating power.

Thus, two oils may be sold at the same price per gallon, but if one gives one-third more light than the other, it will obviously be to the consumer a much cheaper oil.

The mode in which the relative illuminating power of any two or more samples of oil is ascertained is, in reality, not a difficult process; it is one that any intelligent person who possesses a fair balance can readily perform, and thus arrive at a satisfactory conclusion respecting the value of the oils submitted to the examination.

During this week we have been examining the illuminating power of Young's paraffin oil, as compared with that of some of the lighter petroleum oils in the market.

This examination was conducted as follows:—Two lamps of precisely similar character were filled with the oils to be compared, they were then carefully weighed, so as to ascertain their weight to a single grain. The lamp A, filled with Young's paraffin oil (specific gravity .825), weighed 7039 grains. The lamp B, with light mineral oil (specific gravity .810), weighed 6789 grains.

The lamps were then placed close together on a table, and at an equal distance from a sheet of white paper pinned against the adjoining wall. At a convenient distance between the lamps and the sheet of paper a perpendicular bar was so placed that the shadows cast by the two lamps were in actual contact. In the experiments in question this arrangement was made by leaning the long handle of a carpet-broom against the edge of the table, the head resting on the floor.

The flames of the two lamps were so adjusted by turning the wicks up or down that the shadows cast were of perfectly equal depth, proving the flames to be of equal illuminating power. After burning for more than an hour, the two flames were extinguished at the same moment, and the lamps with their contents again weighed. The lamp A was found to weigh 6797 grains; this amount subtracted from the original weight proved that 242 grains of oil had been consumed. The lamp B weighed 6455 grains, proving that it had consumed 334 grains of oil.

Hence it follows that 242 grains of Young's paraffin oil gave out an equal amount of light to that furnished by the combustion of 324 grains of the lighter oil; if to this difference be added 2½ per cent. for the difference in specific gravity, the experiment, so far as this particular sample of mineral oil is concerned, proves that one gallon of Young's oil is equal in illuminating power to one gallon and four-tenths, or more than one gallon and a-third, of the mineral oil examined.

It is but fair to state that the mineral oil was not of the best quality, its specific gravity was only .810, and its inflaming point was as low as 110° F., a point at which oil cannot be regarded as safe in general use. On the other hand, it is but right to state that Mr. Young claims for his oil a greater illuminating power than that possessed by any other oil. On this point we are about making a series of comparative experiments, and shall lay the results before our readers.—*Oil Trade Review.*

The London Gas Companies.—The *Journal of Gas-Lighting*, in alluding to the unexampled prosperity of the gas companies of that city, intimates that this prosperity has been so marked as to be attended with some danger to the shareholders. "Ten per cent. dividends," says the *Journal*, "with a surplus to raise the back dividends to that amount, are considered by the shareholders to be their established right, and gas shares are quoted at premiums of 80 and 90 per cent." The danger to which which our contemporary alludes, seems to be in the form of opposition new gas companies, which are regarded as such dreadful intruders by all regular companies. We quote from the *Journal*, as follows:

"The extraordinary prosperty of some of the companies, especially of the Great Central, is attracting the attention of capitalists, which is quickened by the discontent expressed in many quarters at the results of the compromise of 1860, which has hitherto proved, with two exceptional instances, advantageous only to gas companies without having conferred any corresponding benefit on the public. Projects are, we have reason to believe, in embryo, which nothing short of an immediate reduction in the price of gas to 4*s.* per 1,000 ft. can prevent from coming to maturity, for forming a competing metropolitan gas company; and, should they assume a more substantial form, a still greater reduction in price might be necessary. This is a matter which requires the earnest consideration of the gas companies of the metropolis. A reduction of 6*d.* per 1,000 feet may, for a time, diminish the dividends of some of them; but such a diminution would be amply compensated by the increased stability which the removal for competition would give to the companies who are already in possession of the ground."

Breakage of Glass Lamp-Chimneys.—The Hamburg correspondent of the London *Oil Trade Review*, says:

"Great complaints having been made in the local papers here, by housekeepers who burn petroleum in their lamps, of the great number of cylinders broken by the excessive heat emitted, I suggested a very simple remedy that I have seen practised in other countries in the south of Europe, and which has now become generally adopted here. As many of your readers may have had reason to make similar complaints, I venture to give them the benefit of my experience, as the remedy is very simple, and easily obtainable in every town and village. It consists merely in making a longitudinal scratch with a glazier's diamond from the top to the bottom of the chimney or cylinder, the effect of which is that, as the glass expands with the heat of the lamp, it forms a crack all the way down, and opens to a certain extent while in use, and closing again as it cools. Thus the danger of the glasses breaking by the heat is entirely obviated."

A better remedy than the "longitudinal scratch" may be found in Dithridge's patent oval chimney, which is shaped somewhat like the flat flame of the coal-oil lamps, and is the best invention of the kind we have seen. It needs but to be known to be appreciated.

PAPERS ON HYDRAULIC ENGINEERING.

BY SAMUEL M'ELROY, C. E.

No. 3.—Pumping Engines.

[From the Journal of the Franklin Institute.]

(*Continued from page 247, Vol. IV.*)

BOILERS.—Having referred to *Pumps* and *Engines*, the third sub-division of our subject brings us to the discussion of the generators of power in the boiler-room.

Of the three leading classes of boilers, stationary, marine, and locomotive, the latter has maintained its original type with much greater uniformity than the others, which show, as we also see in the case of pumps and engines, a strange diversity of opinion developed in numerous varieties of form.

Aboard ship and ashore, the simple process of water evaporation has been attained with the most varied forms of boilers, which would occupy a long list in the mere enumeration. As to the wagon shape, dome shape, and circular shells, with chambers, passages, water spaces, flues and tubes, spiral, upper returned, lower returned, double returned, vertical, inclined, and horizontal, in either steam or water conduits, our text books are full of examples, which go very far to show how much a simple process may be overlooked or overburthened in the zeal of invention or the fever of mechanical transpositions; and the practical comment experience has made on the greater part of all these devices is, that they fail to yield a reasonable per centage of useful effect, and come far short, as a rule, of the natural law of evaporation.

The first requisite of a boiler is, that it should yield the greatest possible useful effect from its fuel combustion; the second requisite covers certain details of strength, durability, tightness, ease of access and repair, and compactness of form. These requisites should control the construction of boilers, and involve the general discussion of their operation and proportions—a discussion which may properly be directed to the *furnaces, interior form, exterior form,* and *appurtenances,* and some peculiarities of management.

Furnaces.—Chemistry demonstrates in clear and unequivocal language, that the process of full combustion is controlled by certain laws of combination, which must be carefully observed to attain maximum results. Without pausing here to quote the basis of the scientific theories on this subject, their lessons may be briefly summed up in the statement that the chemical union of the carbon and hydrogen of the furnace with the oxygen of the atmosphere, requires about 150 cubic feet, or 11.48 pounds of air for the perfect combustion of one pound of coal; and that from the difference between chemical *mixture* and chemical *unity*, combustion will be imperfect through the production of carbonic oxide in place of carbonic acid gas, and otherwise, if this *unity* is prevented. In how many boiler shops of the country is it understood, that practically the coal which goes upon the grates is the mere basis of combustion, bearing a proportion of only one-thirteenth or one-fourteenth to the real agent, and that the vitality of each boiler depends on the length, breadth, and depth of the furnaces, and the supply of air through the ash-pits, grates, and other inlets, which may or may not be provided? The self-styled "practical" man believes that his boiler is made to burn coal; the engineer understands that it really burns air, and loses in efficiency by the percentage of air it fails to consume.

The subject of air supply to furnaces has been carefully investigated by numerous experiments in England, which, while more particularly directed to the prevention of smoke, have also made it plain that the ordinary grate openings are insufficient, and the surplus may be beneficially introduced in the furnace or the flue contiguous to it, provided the "mechanical mixture of the air and gas be continuously effected, before the temperature of the carbon of the gas (then in a state of flame) be reduced below ignition."* The investigations of Messrs. Prideaux, Clarke, Williams, and various other experimenters, confirm very fully what is theoretically obvious as to the ordinary grate opening, while the experiments with locomotive fireboxes, both in England and this country, also demonstrate clearly the benefit of air supply above the grates, and directed towards the coal, rather than through it.

* C. W. Williams on Combustion of Coal, p. 89.

In many of the marine boilers recently built for the naval steamers, and some of our stationary boilers in water-works, as at Hartford and Brooklyn, and other instances, the fire doors have the inner plate perforated with numerous small holes, which may be used or not, as a valve in the outer plate is regulated. This accomplishes the object to a certain extent. Various devices, in the use of feeding tubes, hollow grate-bars, hollow stay-bolts, and other means of air supply have been tried on the North River steamboats, and otherwise, in some cases with very satisfactory improvements. All these steps of progress, under the guidance of natural laws, must eventually lead to good results, when the laws themselves are clearly comprehended and followed.

On the matter of furnace proportion, and other like proportions, the text-books on the steam-engine, as a class, pretend to lay down certain fixed rules, based on what is called "nominal horse power." This basis is one of the mechanical absurdities of the day, which is so entirely disconnected from actual horse power, and is itself so variable in its self-selected standards, that the common sense of the profession in this country rejects it, and defines the measure of actual work and capacity for work, as the only correct basis of calculation. Where we know that the combustion of coal may be raised from 8 to 20 pounds per square foot of grate per hour, and the steam-pressure from zero to 60 pounds and over, in the same boiler, we also understand the folly of fixing its power by the size of the cylinder to which it may be attached, itself susceptible of great fluctuations in actual work.

There is, however, to each furnace, as to its connecting parts which form the entire boiler, a certain action of maximum useful effect, which involves the real problem of study and experiment, and has been too much overlooked in the ambition for novelty in form and patentability.

Of the several devices for automatic fuel-feed and cleaning, which have been invented and put in operation, however correct in principle, none have as yet offered a safe substitute for the ordinary manual attendance; and for the present our boiler furnaces should be adapted to the conditions of this attendance.

We may say then, from considerable observation of actual results, that the ordinary length given to our furnaces of 5½, 6, and 6½ feet, is entirely too great for careful firing, and that in various experiments it has been found advantageous to brick up the lower end to about 5 feet. In this respect our experience has confirmed the rule of those English engineers who advocate smaller grate areas, and larger furnaces, the former, from the superior convenience of management, and the latter from the superior process of combustion. For similar convenience of management, comparatively narrow furnaces are advised, since the water spaces between them thus obtained, when made of proper width (in no case less than 4½ inches), form with their stud-bolts efficient sources of evaporation. It may also be taken as a rule, that the grates should be placed considerably below the flues, and not less than 30 inches below the crown sheet. Some remarkable improvements, from increase of bridge-wall, have been attained in special cases, and as to advantage in fire-box depth, every locomotive is a sufficient example, if the theory of combustion required further elucidation.

As to the strange varieties of grate-bars, which exist and occupy with their patterns rows of shelves in our pattern-rooms, it is enough to say that the bar should be narrow, with an upper groove to hold ashes for its protection from heat, deep in section, tapering to an edge, with liberal interspaces, and so bridged as to offer no hindrance to the use of the slice-bar or cinder-hook.

The use of thin, even fires, cannot be too strongly urged, from their effects on air supply and combustion. Four or five inches in depth give a careful fireman much less trouble than the barbarous masses of fuel too often seen in marine and stationary furnaces, and always improve a steam-guage, while they reduce the coal account. We have reduced fires too often to put a steamer's boilers in racing order, not to have learned this experimentally, and there are abundant illustrations of the doctrine extant in our scientific treatises, if practice should seem to dispute it.

If fires are kept light, the corners carefully watched, the slice-bar judiciously used, and the supply regulated, the furnaces may be run for comparatively long periods in highly efficient state, without the wholesale cleaning expedient of "hauling" fires, which is objectionable in several respects, and more especially as to dirtiness and wastefulness.

It should be remembered also, in all cases of boiler design, that the furnace holds, in every boiler, an essential relation to the water evaporation; its fire surface, from the great intensity of its radiated and conducted heat, being by far the most effective in proportion to extent to any other heating surface. Aside, then, from this obvious propriety of a large combustion chamber, the question of heating surface dictates the use of roomy furnaces.

Internal Form.—Acting in connection with the furnace or furnaces, by means of flues, tubes, and other conduits, the heated gases are conveyed in direct or broken lines to the chimney flue, or smoke stack, the aggregate length of travel, or amount of surface passed, differing materially in different types of boilers, each of which have, or have had, their warm advocates.

Although the object of each of the various forms or arrangements, internally as well as externally, has been to utilize most effectively the products of combustion in meeting the special objects of design, and in such cases as the locomotive boiler and others, certain special uses and requirements control the general design, it must be said of the various forms, as a whole, that they cannot all be correct in principle, or adequately fulfil the measure of their duty. It is true that different and local varieties of fuel may and should have some control over boiler design, as also in marine boilers the use of sea-water and the want of space affect relative forms and positions, but above all special and local corrections, boiler construction and use ought to be regulated by general principles, applicable to the entire classes.

Looking upon the various forms of gas and steam passages and chambers, water-spaces, and the like, as passing vagaries of construction, we may notice the relative claims of the more common and plainer internal forms, as to the question of flues and tubes.

We may take it for granted, also, that for greater advantage in strength, effective surface, and compactness of form, the flue boilers are to be preferred to the more primitive wagon-shaped and similar forms of boilers, which pertain to the days of ruder workmanship and more wasteful combustion, and have gone almost out of use.

The use, also, of the long, cylindrical, single flue boiler, seems to depend on certain habits or conveniences of use and construction, rather than any inherent advantage in form.

Notwithstanding the various arguments on the relative merits of slow or quick combustion, in which the Cornish and the Mississippi boilers are at strange antipodes of practice, it has been sufficiently demonstrated by observations we need not pause here to cite, that, except some slight allowances for differences in structure of coal, slow combustion is not economical, and that boilers of this type are not more economical than those of the marine or American type, of more compact form. We may assume, then, for the present, that the question of flues and tubes is important as pertaining to the general form demonstrated most efficient.

The transfer of the system of small horizontal tubes from the locomotive boiler, working with a steam blast, in which such tubes are matters of necessity, to marine and stationary boilers, operating under very different circumstances, appears to result from a desire to economize space; and the change of tube position to vertical lines, appears to result from a misconception of the action of vertical surfaces as steam generators. We say this with a resesvation in favor of fire-engine boilers, or the Prosser boiler, and their class, which are expressly adapted to certain uses, or to superheating, or other collateral objects, having reference more generally to the recent patterns of marine and land boilers of multi-tubular form, which claim the advantages of large effective fire surfaces in reduced compass.

Taking any internal arrangement in consideration, it must be observed that by far the most active steam generator, with either flues or tubes, is the furnace sur-

face. Experiment has shown, in locomotives, that two-thirds to three-quarters of the evaporation is produced at the fire-box, and observations on marine boilers (to which we may specially refer) tend to confirm this general statement.

It may also be said, that in reference generally to vertical surfaces as contrasted with the horizontal, vaporization depends on the quantity of heat taken from the plates, rather than that applied to them, and experiment confirms an inference deducible in theory, that the formation and slow discharge of steam bubbles on the former, prevents the free and proper return current of water, and interferes with surface efficiency. And, as to all classes of heating surface, efficiency is seriously controlled by the freedom of steam-vent and of return water supply, as a modification of simple plate conduction of heat. From the use of vertical tubes or plates, two results then follow—first, that the generation of steam is hindered, from imperfect delivery of its globules, and, second, that the tubes are themselves liable to injury for want of adequate contact with the water, as a protective. Such fire surface cannot, therefore, be considered fully effective, and is not a correct measure of evaporative power.

In the group of horizontal tubes, the narrow water-spaces and obstructed circulation for steam delivery greater facility in construction, transportation, and bedding, strength of shells and braces, preference has generally been given to circular shells with steam-domes, which elevate the supply steam-pipe considerably above the water level, and when surrounding the uptake of the chimney, superheat their contents with most valuable effect.

As to proportionate length, in circular boilers with drop-return flues, and smoke flues below the shells, from experiments made on water-works boilers with a high-range thermometer, which confirms the principle laid down by English authorities in other forms of boilers, we consider from three to three and a-half times the diameter a liberal limit, which cannot be exceeded without detriment, and may admit considerable reduction.

In the drop-return boiler of the Hartford Water-Works, which is conveniently accessible for temperature experiments, with a circular shell of 22.66 ft. length, a diameter of 7.5 ft., a furnace 7 ft. wide by 6 ft. deep, 4 upper flues of 18 ins. diameter by 14.33 ft. long, and 16 lower return flues, 13 of 8-inch, 2 of 9-inch, and 1 of 12-inch diameter by 12.25 feet long, the following temperatures were noted for an ordinary combustion of 6.4 pounds per square foot of grate, with a steam-gauge of 25 pounds:

steam-stop valve, in order to control its action properly, and these should be proportioned to the limit of duty required in steam and water supply. In flue boilers, on the back connections, a plug-hole should be made opposite each flue centre, for convenience in examination and cleaning. Manholes and handholes should be made for the same use.

In addition to the ordinary pressure-gauge and water-cocks, each boiler should also have a glass water-gauge, the latter furnishing an important index to internal operations. For experimental observations on quality of coal and other notes of consequence, a feed-tank is valuable, as an appurtenance to the boiler-room, in which the exact supply may be measured, measurements of evaporation by tank being much more accurate than by volumes of steam.

Although the ordinary use of auxiliary steam-pumps is objectionable on account of cost in steam, to every group of boilers such a pump is valuable for special service, and particularly in connection with pumping-engine wells and force mains, to which they should be attached.

In boiler-feed, of course the supply should be taken from the hot-well, and where the feed-pipe can be carried through the boiler connection, some benefit may be derived from the heat imparted; but the use of small

BOILER EXPERIMENTS.

Location.	Varieties.	Size.		Square Feet Surface.			Tubes or Flues.		Pounds Water Evaporated.				Coal.		Time.	No. of Boilers.
					Fire.				Indicator.		Tank.					
		Length.	Diameter.	Grate.	Nominal	Effective.	No.	Diam. Inches.	From	From 212°	From	From 212°	℔ sq. ft. grate ℔ hour.	Total used.	Hours.	
FLUE BOILERS.																
East London Water-Works	Wagon head.	24.16	5.91	37.26	588		1	36x30			80°					
	Cornish.	27.88	6.5	224	3192		4	46			8.3		10.89		82	1
	"										8.52		4.68		504	4
	"										8.42		2.59		514	4
Old Ford	"										8.3					
Loams Engine	"										9.16			1568000	6 mos.	
Par Consols	"											11.43		119700		
Jersey City Water-Works	"	34	7	60.66	2450		3	52	100°		100°					
									7.49		9.77		4.96	1806	6	3
									7.48		9.88		4.84	3524	12	3
U. S. Steamer *Fulton*	Drop Return.	22	10.5	112	2200		12	16	8.77				20.		5.3	2
Smithery, N. Y. Navy Yard	"	24	4	19.25	380		5	12	4.97				14.08	9891	35	1
									6.02				12.42	9896	39	1
									6.15				11.92	8650	35	1
Hartford Water-Works	"	22.66	7.5	23.12	909	609	4	18	6.09		10.01		6.91	400	2.5	1
									8.39		10.96		5 08	1117	8.5	1
Brooklyn "	"	30	8	112.5	4064	2709	12	18.5	9.27				11.86	34773	26	3
Cambridge "	Upper Return.	20	4.16	7.15	488		20	4			10.89		5.04	542	12.25	1
10 Ocean Steamers, average bituminous coal									5.14							
9 " " " anthracite coal									7.23							
TUBULAR BOILERS.																
Prosser Patent	Vertical.	8.75	2.5	2.25	112.8		100	1.25	8.58	9.53	9.95	11.03	14.28	257	8	1
U. S. Steamer—*Niagara*	"	21	13.66x15	484	12817		8160	1.81	7.				14.25	6900	1	4
									9.05				8.38	4059	1	4
" *Michigan*	"	16.66	9.5x9.2	90	2690		1504		5.57	6.20	8.40	9.36	3.80	26667	72	2
									4.94	5.50	7.86	8.76	4.11	24600	72	2
									6.26	6 98	9.06	10.10	5.21	33766	72	2
									5.76	6.42	8.60	9.60	6.28	40740	72	2
									6.69	7.45	8.17	9.10	9.51	61657	72	2
									6.91	7.70	7.40	8.25	11.41	73944	72	2
									7.23	8.05	7.44	8.29	18.52	120024	72	2
" *Susquehanna*	"	15	11x13.5	169	5851		2740	1.81		9.14				4200	4	2
" *San Jacinto*	"	21.25	11x11.25	108	3073		1620	1.81	7.89	8.80			8.92	92512	96	1
" "	Horizontal.	21.25	11x11.25	108	2663		414	2.78	6.82	7.61			9.63	100436	96	1
H. B. M. Gun Boats		14	4	29.25	864		96	1.5	7.47							
Ellis' Patent	"	13	4.75x7	14	563		50	2.5			9.07	10.01	13.57	1900	12	1

Authorities: Sewell's "Steam and Locomotion," Prideaux on "Fuel," C. W. Williams on "Coal Combustion," Armstrong on "Boilers," Stewart's "Naval and Mail Steamers," Isherwood's "Precedents," &c.

and water return, also reduce the evaporative effect, and account for the rapid destruction of this part of the boiler, and its constant need of repairs. In fact, for both vertical and horizontal tubes, the chapter of repairs is sufficiently voluminous to justify a decided preference for more simple and accessible forms, afloat and ashore.

It is not only a matter of inference, that the plain upper arcs of horizontal flues of moderate size, with liberal water-spaces, are more favorable to vaporization than groups of small and crowded tubes, while the avenues of passage for the heated gases from the furnace are also enlarged and improved, but it is a matter of experimental record in special cases, which further and more general experiment would undoubtedly confirm, that in actual evaporative results, flue boilers, judiciously arranged, exceed the multi-tubular. And they have, in addition, those advantages to which we referred in the outset, viz.: strength, durability, tightness, ease of access and repair, with compactness of form.

External Form.—As connected with the internal arrangement of furnaces and flues, it may be taken as a rule, from advantages in steam generation and demand, from liability to priming, cost of boiler-heating, equality of pressure, and other obvious reasons, that the water surface should be a minimum and the steam-space a maximum. On this account in part, and also

Back Connection.

At upper flue end	550°
At middle flue end	400°
At lower flue end	370°
In the chamber	334°

Return under the Boiler Shell.

At under side of boiler	284°
At centre of passage	240°
At side of passage	209°
At floor of passage	160°

It was very evident from these results that the gases leaving the furnace at about 1900°, were retained too long within the boiler structure, which for a part of the flue travel was actually reducing the boiler temperature, at the ordinary and most convenient rate of combustion for the engine-work. In this case, with the grates bricked over to an open area of about 23 square feet, and a total heating surface of 909 square feet, of which but 609 were calculated as effective, the proportion of heating to grate surface was $909 \div 23 = 39.5$ to 1, the proportion of length to diameter being $22.66 \div 7.5 = 3$ to 1. As will be observed in the table given in this paper, this boiler ranks high in vaporization, and with a more rapid combustion would of course modify and improve the temperature of its lower flues.

Appurtenances.—Each boiler should have an independent safety valve, feed-valve, blow-off valve, and pipes, or coils of pipes, with abrupt turns, is to be avoided, as being much more expensive in friction than any apparent gain in temperature can compensate, the relative heat of feed-water being less important than is generally supposed, within the range of a few degrees.

The importance of bedding a boiler on cradles, is now commonly recognised, for convenience of access, inspection and repair to the lower shell, and the necessity of avoiding any strain from improper supports, is obvious.

From the important losses by radiation and leakage, perceptible or imperceptible, the value of careful covering by non-conductors may be strongly urged, as sources of increased efficiency and economy, and as regulators, to a certain extent, of evaporative action and tensile strain.

Tight and permanent floors, substantial walls and roofing for the boiler-room, liberal working space for the firemen, selected firing tools, separate chambers for the coal and coal-screens, metallic troughs for the hot cinders and ashes when hauled, and other like conveniences, not only promote the comfort of the attendants, but also advance that care of details, which always reduces the aggregate expense account where so much depends on manipulation and oversight. All such expenditure are admirable investments.

Fuel.—As between the use of wood and coal for combustion, the former, except for convenience in

starting fires, bears no comparison in quality. Between bituminous and anthracite coal, experience in this country has established the superiority of the latter for stationary and marine uses, as to compactness and firmness of structure in the coal bunker and on the grate, specific gravity, cleanliness, steadiness of combustion, and general evaporative power. While there may be special varieties of the former, of great value when properly used, and with admirable constituents of quality, the white-ash anthracites as a class, are much more economical in quality, and such veins as those of the Scranton and Schuylkill valleys, take the front rank. And yet what is now generally admitted, was as generally denied a dozen years ago.

The theoretical value of one pound of coal, of good quality, as determined from its constituents of carbon and hydrogen, may vary from 13 to 15.5 pounds of water evaporated from 212°. As a general rule, among the complex stationary and marine boilers in use, not more than one-half this result is realized in practice, and sometimes not more than one-third.

Sewell (*Steam and Locomotion*, p. 99). refers to a range of results from 10.74 to 12.89 pounds, obtained by Cornish engineers in 1840 and 1846, and mentions other results of 13.48 pounds on an experiment boiler, 11.428 pounds from 212° from the combustion of 11,730 pounds of coal, at the Par Consols mine, while other instances of similar rates of practical evaporation on record in engineering works, furnish a severe comment on the enormous daily waste of fuel in our workshops and engine-houses, and at sea.

Duty Tests.—In various experiments, recorded from time to time on pumping and other engines, it has been customary to bring the boilers up to their state of effective operation, and commence a set of parallel observations, at the close of which an attempt is made to leave them in precisely the initial state assumed. The objections to this process in all short experiments are important where close measurements of coal are needed, and have been discussed at length in former pages of this *Journal*, more particularly on page 239 of Vol. XXXV., 1858, in which a different method is presented, by taking the boilers with fires hauled after being properly warmed up, and hauling fires at the close of the experiment to determine the value of the grate contents, in coal, cinder, and ashes, accounts being thus kept of all the fuel used from the time of starting the second fires.

(*To be continued.*)

THE GAS-WORKS OF THE ST. NICHOLAS HOTEL.

American hotels are renowned as being on a scale of size and magnificence of appointment superior to those of any other country. The successful management of these vast houses requires a degree of tact and executive ability possessed by but a limited number of men, and the details of conducting the business are by no means insignificant, either when viewed alone or considered in the aggregate. The capital required to keep a hotel in one of our great cities amounts to a very large sum, while the various items of furniture, provisions, wines, servant hire, lights, &c., together amount to a fortune enough to satisfy the wants of an ordinary man. Notwithstanding the opinions of certain well-known travellers, including Mr. Anthony Trollope, who speak sneeringly of the comforts to be enjoyed at an American hotel, they are institutions which the travelling public know well how to appreciate. They keep pace with the age we live in, and may be considered as indispensable to the wants of the people.

When the Astor House was first built and opened for the reception of guests, it was regarded as a modern wonder. Its fame soon spread throughout the country, and even to foreign lands. A hotel so immense was in those days something entirely new, and crowds of people flocked to see it from motives of mere curiosity. Following in quick succession came the Irving, Metropolitan, and St. Nicholas hotels, the latter excelling them all in point of size and gorgeousness of furniture, and being capable of accommodating more than a thousand guests—thus enclosing within its walls a population equal to that of many of our thriving towns and villages.

The supply of artificial light to this large number of guests, together with the large consumption required in the public offices, dining-rooms, and halls, is, as may be supposed, no very trivial matter. Suffice it to say, that there are at the St. Nicholas Hotel about 3,000 burners in constant use, and in the shortest days in winter the nightly consumption of gas amounts to about thirty-six thousand cubic feet. At the rate of two dollars and fifty cents per thousand feet, which is the regular rate charged to consumers, large and small, by the Manhattan Gas-Light Company, in whose district the St. Nicholas is situated, the nightly bills of this hotel would amount to a very respectable sum, the yearly aggregate being a large amount. The Manhattan Company being averse to allowing a discount to large consumers, but compelling them to pay the same prices as a private family consuming but a few dollars' worth of gas per annum, have lost such customers as the St. Nicholas, St. Denis, and Fifth Avenue hotels, each of which has its own gas-works.

The gas-works of the St. Nicholas Hotel are situated directly in the rear of the house, at No. 63 Mercer street. Until within about two years since, rosin was the gas-yielding material employed, but since the enormous rise in price, from about one dollar to thirty dollars per barrel, it has been rigidly excluded from all gas-works as being entirely too costly to use. After the use of rosin was abandoned, a substance called "candle stock"—the refuse material from adamantine candle manufactories—was substituted. This yielded a fair gas, although it was not so easy a task for the engineer to control the operations of the works, nor was the supply of the stock sufficient to justify any expectations of permanency. These works, therefore, succumbed to petroleum and water gas-works erected by Mr. James E. Thompson, of Toronto, C. W., who tore down the whole interior of the retort-house and rebuilt a bench of his own construction and design, for the purpose of making gas from petroleum and water. Mr. Thompson's works were put in operation in December of last year, and at first gave such uniform and satisfactory results that but one opinion was expressed of them. The proprietors of the house gave a highly laudatory certificate respecting the working of the process, and all seemed to be going on very smoothly, when, about ten days after the works had been started, they became unmanageable, and no light could be obtained in the house. The proprietors of the hotel were obliged to resort to the gas of the Manhattan Company, which was consumed by them for some months, until the present works were erected.

In the meantime, Mr. D. Parrish, Jr., of Philadelphia, had successfully lighted the Fifth Avenue Hotel, to the satisfaction of the proprietors and the guests of the house. As the process he had put in operation at the latter hotel seemed to work with great regularity and precision, and the quality of the gas seemed to give general satisfaction, Mr. Parrish was authorized to remodel the St. Nicholas works, which he at once proceeded to do. He completed his task, and on the 14th of May last his works were started, and have since that time been in constant operation without the stoppage of a single hour.

In the retort-house are two benches of threes. The retorts are of iron, and are set in the manner usual in most coal-gas works, the tiles and flues being arranged precisely as in a coal-bench. The retorts are, in section, segments of a circle of 12 inches internal diameter, the bottom being flat. Inclusive of the mouth-piece, they are 7 feet 6 inches long. They are open at both ends, and are connected at the back by means of the ordinary stand and dip-pipes with the hydraulic main. In the lid covering the front of the retort is inserted a syphon, the tube of which projects a few inches into the retort.

Petroleum tar is the material from which gas is made. This is allowed to flow in a thin stream into the syphon, which conducts it into the retort, where it falls upon a body of incandescent coke, through and over which the gases and vapors are obliged to traverse before escaping at the back of the retort into the stand-pipes and hydraulic main. This petroleum tar is eminently adapted for the generation of gas, being but a little inferior to rosin, and being applicable in rosin gas-works with but a slight alteration. As the lighter hydrocarbons, such as naphtha, benzine, and the like, have been removed from it by preliminary distillation, there is no liability to condensation in the pipes and mains, which is always the case where gas is made from crude petroleum. The yield of gas from petroleum tar will average 60 feet to the gallon, and its quality is far superior to that of coal-gas.

Paradoxical as it may seem, this very richness of gas made from petroleum tar is a cause of complaint by reason of the liability of rich gases to smoke; and in order to obtain the benefits and avoid the disadvantages of this excessive richness, certain expedients have been resorted to. The first which naturally suggested itself, was to decrease the size of the burners, and to consume a smaller quantity of gas, so as to cause each molecule of gas to be surrounded by a larger proportion of atmospheric oxygen, by which the excess of carbon is consumed and smoking prevented. But when very small burners are used, their tendency is to weaken the body of the flame, so that it is influenced by the slightest current of air, and even with small burners smoke will ensue in places subject to draughts. Another expedient which was employed by Mr. Thompson, was to introduce water into the retort, so that the hydrogen and carbonic oxide resulting from its decomposition, would reduce the rich hydrocarbon vapors and gases to a lower hydrocarbon condition, and thus make a gas of such a composition as to permit its being consumed in ordinary burners. This process, however well it may have promised theoretically, and however successful it may have worked elsewhere, proved impracticable at the St. Nicholas Hotel, and was abandoned. The introduction of the streams of water into the retort had a tendency to cool down the temperature to a lower degree than was necessary for the production of gas, condensible hydrocarbons only being formed—hence the stopping up of the pipes and the failure of the works.

Mr. Parrish has adopted a plan substantially different from those above mentioned—a plan which has its ardent advocates and bitter opponents, but which by its successful working will live down all opposition. It is simply by mixing certain proportions of atmospheric air with the rich gas *after it leaves the holder*, and after it passes through the meter. The admixture of air with the gas accomplishes two objects. It dilutes the gas to a degree which renders smoking almost an impossibility; at the same time it promotes economy of consumption; for the mixed gas and air is of so high a specific gravity as to flow through the pipes and burners very slowly, and thus it consumes at but a moderate rate. The particular point of interest about this part of the process is the apparatus in which the mixture of gas and air is effected, and by which the exact proportion of each is accurately and unerringly determined. This apparatus is the invention of Mr. Parrish, and it has been recently patented by him. It consists of an ordinary gas-meter, of a sufficient size to supply the entire consumption of the house—a station-meter, as it were, connected and geared with which is another meter revolving in an opposite direction. The operation of the apparatus is perfectly simple. The pressure of the gas-holder forces the gas through the meter, causing it to revolve in the usual manner. The gas-meter being geared to the air-meter (which revolves in an opposite direction), causes it to draw in a certain quantity of atmospheric air, which is forced along until it meets the column of gas which has just passed the gas-meter. The two meters are connected by pipes in which the gas and air are thoroughly diffused and mixed, and thence passed on to the burners.

In practice it has been found that the proper proportion of gas and air varies with different circumstances: depending entirely upon the richness of the pure gas. If this be of an average richness, about 40 per cent. of air is the proper proportion. If the qualtity of the gas exceed the average, it may require 50 or even 60 per cent. of air. This can be readily determined by the photometer, and the adjustment can be made in a moment.

The peculiarity of Mr. Parrish's mixer is, that by simply moving a lever the instrument can be so adjusted as to pass any required proportion of gas and air, with an exactness which it would be impossible to mistake.

A great advantage of burning mixed-gas and air is experienced in hotels, factories, private houses, and the like, where but limited storage capacity can be had.

At both the St. Nicholas and the Fifth Avenue Hotels the gas-holders are necessarily much too small for the supply of the house with ordinary gas. By the operation of this process and the use of the mixer, the gas-holders perform all the functions of holders occupying 60 to 80 per cent. more space. Thus, suppose the gas-holder to be of a capacity of 6,000 cubic feet, and the mixing apparatus be adjusted to pass 40 per cent. of air, the holder would be doing a duty equivalent to a holder of the capacity of 10,000 cubic feet.

The proprietors of the St. Nicholas Hotel, in addition to having their gas-works on the premises, and the gas furnished to them by contract, by which they are saved all trouble, likewise have the satisfaction of knowing that they save, in the item of gas alone, not less than $10,000 per annum, which formerly went into the pockets of the Manhattan Gas Company.

COAL AND PETROLEUM.

The July number of *Harper's Magazine* contains a highly interesting article from the pen of Professor Henry D. Rogers on the subject of coal and petroleum. We should like to present the whole of the paper before our readers, for it contains many valuable suggestions as to the origin of petroleum and its relations to the coal formations. But as we cannot afford room enough for this we must content ourselves with making copious extracts from the article. Of coal the Professor thus speaks:

"Coal is not a substance of uniform elementary constitution. It presents itself, indeed, in many varieties, each adapted to especial applications and wants in the economy of human affairs, yet all of them so related as to bespeak, when compared with one another, a most interesting phasis in their history. The most currently used classification recognizes but two chief sorts—common bituminous coal and the non-bituminous or anthracitic; a nicer subdivision is founded on the relative abundance of the uncombined carbon or coke, and the volatile or distillable and inflammable bituminous matters so called. These, in the phraseology of chemistry, are known as the *hydrocarbons*—a group of substances in liquid and gaseous conditions, according to the temperatures they exist under, and all constituted of hydrogen and carbon united in definite proportions. A coal destitute altogether of the hydrocarbons is a true anthracite; if it contains some ten or twelve per cent. of those volatile compounds, and burns with a soon-exhausted flame, it should be called a semi-anthracite; if it have as much of them as twenty or twenty-five per cent. it is best termed a semi-bituminous coal; and in all cases where it possesses as much as or more than thirty per cent. it claims the title of a true bituminous coal. All these four classes may be divided into sub-varieties, founded not on the amount, but rather on the specific nature of their hydrocarbons or flame-making elements, and partially on the texture or physical structure of the coal as a rock. Such, for instance, is the distinction between the cannel and ordinary coals. There is a general law in the geographical relations of the above-named four classes of coals—noticeable in crossing many of the larger coal-fields, especially those of the United States between the Alleghany Mountains and the Missouri River—which will demand our attention when we enter presently on a consideration of the physical conditions which have produced the rock-oil or petroleum which so abounds in certain districts. To this and the other hydrocarbons, the associated inflammable gases found escaping naturally or extracted artificially from the earth, let us now direct our attention."

The difference between the natural hydrocarbons is thus pointed out:

"The chief of the chemical compounds of hydrogen and carbon (hydrocarbons) which issue spontaneously or are derivable from the strata under the soil are the so-called bitumens and petroleums, and the carburetted hydrogen gases. Bitumen properly embraces several hydrocarbons, some solid, some liquid. Asphaltum, one of them, is a brownish-black solid substance, of bright fracture, and burning with a brilliant flame; and naphtha, another chief ingredient, is, when pure, a colorless liquid of bituminous odor, and a specific gravity about three-fourths that of water. Petroleum, strictly defined, is a dark-colored liquid compound of the hydrocarbons, containing much naphtha. Asphaltum in a semi-solid shape abounds on the shores of the Dead Sea; it also borders the famous bitumen lake of the Island of Trinidad. Naphtha flows profusely from the ground in some localities in Persia, also in the Birman Empire. It is stated that at Rangoon there are upward of 500 wells of naphtha, yielding annually more than 400,000 hogsheads of the oil. The bitumen lake in Trinidad is half a mile in breadth; the materials are solid at its shores, but liquid and even boiling toward its centre. This lake is said to repose upon a bed of coal."

After alluding to the extent of the North American petroleum region, from the sourthern portion of the Ohio valley to Georgian Bay, in Lake Huron, and from Alleghany Mountains in Pennsylvania to the western limits of the bituminous coal-fields in the vicinity of the Missouri River, Professor Rogers takes up the geology of the petroleum basin, which he discusses more intelligibly than any other writer whose papers have come under our notice. Petroleum has been found in the States of New York, Pennsylvania, Ohio, Illinois, Michigan, Kentucky, Tennessee, Maryland, Kansas, Texas, and California. The town of Marietta, Ohio, is considered to be near the centre of the region, the extent of which is estimated at about 50,000 square miles. Referring to the prevalent opinion that petroleum is restricted to the coal measures, Professor Rogers remarks as follows:

"It is an error to suppose that the petroleum and inflammable gases of the great rock-oil region above sketched are all restricted to the coal measures, or even to the carboniferous formation. Geologists of the United States and of the adjoining British Provinces have clearly shown that they rise from strata in those regions seated far beneath the coal. The stratified rocks of the region consist of an immense development of Silurian, Devonian, and Carboniferous deposits of an aggregate depth or thickness of not less than 25,000 or 30,000 feet, or some five or six miles. They include, at the least, three or four continuous and widely-diffused great beds of a magnitude entitling them to be called formations, whose chemical nature well adapts them to yielding mineral oils and carburetted gases as copiously as do any coal measures. The lowest placed, or oldest of these, the Utica black shale, ranging in its out crop from east to west through New York, and thence northwest through Canada, has a variable thickness amounting in some places to 300 feet; this rock is, for the most part, a crumbly shale, of a prevailingly dark-bluish or brownish-black color, and it abounds in bituminous and carbonaceous products; it even contains a few thin, coaly layers, and has often been mistaken for a genuine coal-bearing formation.* It is replete in many places in fossil seaweeds and fucoids, and there can be little doubt that it owes its richness in carbonaceous matter mainly to these plants. Petroleum is known, indeed, to issue plentifully from this rock on the Great Manitoulin Island, in Lake Huron. It underlies, be it observed, all the higher Silurian, Devonian, and Carboniferous strata which, in succession, occupy long east and west-tending zones of country to the south of its out crop in New York, Pennsylvania, Michigan, and Ohio. To it must we credit the petroleum and gas-springs which occur north or outside of the districts occupied by the gently south-dipping Devonian and Carboniferous strata."

The following deductions concerning the law of gradation in the increase of bituminous matter in the various hydrocarbons are interesting:

"It is not in fact until we are almost half-way across the great Appalachian basin, in Pennsylvania and Virginia, where its coals are already more than half endowed with the full share of their bituminous matters, that we fairly enter for the first time on the wide territory so marked by tracts or belts of gas-springs and petroleum; and it is only when we approach the western and north-western margin of the vast basin, or get near the Alleghany River, and then enter Western Pennsylvania, Western Virginia, and Eastern Ohio and Eastern Kentucky, that the native or mineral oils and gases gush from the earth in their full abundance. How unmistakably does this curious gradation indicate that the coal measures at least, and we cannot but include the other formations underneath them, must all have undergone at some crisis, or during some long period, a widely diffused and graduated or locally modified and attempered distillation or expulsion of the gaseous ingredients of the carbonaceous strata! This change was an almost total discharge of the volatile matters along the eastern most heated and convulsed zone, with a less and less complete displacing of them from the coaly or carbonaceous beds in the regions further west. There the subterranean action did not wholly dispel the hydrocarbons, but merely saturated or infiltered the pores, crevices, and fissures of the over-resting rocks more or less fully with them. The anthracite belt is like a row of loaves or puddings in a cook's unequally heated oven, where an excess of warmth has dried the dishes to a crust, whereas the other more and more bituminous belts are in the state of articles less and less baked, retaining larger and larger proportions of their primitive juices.

"The hypothesis here suggested, namely, that the volatile hydrocarbons were distilled, as it were, from out the low-lying carbonaceous strata, into the pores and fissures of the over-resting ones, receives strong confirmation from the fact that the elsewhere bituminous shales of the Silurian and Devonian ages deep under the coal, are altogether as much dessicated and debituminized everywhere in the districts contiguous to the anthracites as the coal-beds themselves. Thus while the pies resting within the upper shelves of our hypothetical oven have been over-cooked and rendered juiceless, the already more crusty ones lower down, and therefore still more effectually heated, are seen to be even more thoroughly baked and dried."

Omitting a great deal of interesting matter, we must conclude our quotations, by referring to the professor's opinion of the formation of petroleum:

"We are inclined to attribute the petroleum and its associated hydrogenous gases to a fermentation and distillation, by subterranean heat, of the hydrocarbon elements resident in all the carbonaceous strata underlying the rock-oil region, that is to say, impregnating the Silurian black slate (Utica), the Devonian black shales (Marcellus and Genesee of New York), and the coal seams and carbonaceous shales of the bituminous coal measures. Indeed, we are disposed to assign the oil and gas to the lower-seated Silurian and Devonian deposites, almost exclusively, and for these reasons: First, that they come forth, and very abundantly, in large districts far remote from any tracts of the coal formation, and where those inferior rocks are the only carbonaceous ones which underlie the surface. Secondly, that a like discharge of petroleum and combustible gases occurs in none of the other coal-fields of the earth, even where their coal-beds are notoriously bituminous and dangerously full of fire-damp. Thirdly, there are some differences, so the chemists inform us, between these native hydrogenous products and the genuine coal-oils and their resultants, procured by artificial methods of separation. All these facts awaken a strong surmise, confirmed by the obvious diversities in the specific gravities and other qualities, and by the excessively offensive and non-bituminous odors of some of the petroleums of the countries exterior to the coal-field, such as that of certain localities in Canada, that the greater portion of the oil and gas is really derived from the marine animal carbonaceous shales, and not from the vegetable-beds of coal and their coaly rocks. The occurrence of so many symptoms of rock-oil within the limits of the coal-fields now replaced by such a multitude of productive oil-wells, tells for almost naught against this hypothesis, as it is known that the Silurian and Devonian black carbonaceous shales pass under all the north-western and western districts of the coal measures.

"My view of the process of extrication of the petroleum from the lower strata and of its accumulation in the pores, crevices, and joints of the upper ones, is simply this: We may conceive that during the epoch, or the perhaps successive epochs, of the uplifting of all these water-buried and water-side sedimentary strata, earthquake pulsations and other undulations of the crust formed and fixed the flexures in the strata which we have described, and that during the earthquake oscillations, and even after their cessation, a copious amount of the highly-heated subterranean steam, the constant attendant upon earthqakes, heated the strained and ruptured rocky beds, dislodged their more volatile constituents, and carried or distilled these latter, one portion into the atmosphere and a residuary part into the interstices of the overlying cooler and less fractured strata. Upon this hypothesis we see how in those belts of the Alleghanies where the crust was most convulsed and the rocks were most contorted and highly heated, the coal-beds were actually coked into dense anthracite, and how further from the lines of maximum subterranean pulsation and steaming of the rocks the volatile matters below the surface were progressively less expelled, till entering the petroleum districts the crust movements and warning were so moderate that they only sufficed to displace the tarry and gaseous matters from the underlying beds, to leave them, at least in part, in the cavities and cells and fractures of the over-resting strata."

GAS IN BRAZIL.—A half-yearly meeting of the shareholders of the Bahia Gas Company was recently held in London, England, where the principal part of the stock is owned. At this meeting it was stated that the lighting of the city is now fairly established, the number of public lights being 1,644, and fittings are being rapidly put in private houses. The present receipts for public lights are calculated to amount to $65,000 or $70,000. No balance-sheet was presented at the meeting, the directors "regretting that, as no accounts had been received from Bahia," they were not in possession of such particulars as to reveal the true state of the company. The directors asked for an increase of capital, which they deemed "necessary as working capital," and yet, with no accounts showing the status of the company, and not money enough to get along without an increase of capital, they declared a dividend of 5 per cent. Wise management, this! Some of the shareholders seemed to be a little anxious lest the exceedingly arbitrary conduct of the British Minister to Brazil towards the people of that country might lead to unpleasant complications, but these fears seem, at this time at least, to be unfounded. No doubt the declaration of the dividend was hastened by the possibility of trouble.

PATENTS.

UNITED STATES.

38,657.—C. L. Daboll, New London, Conn., for a Construction of Glass Chimneys for Lamps. Antedated March 1, 1863:

I claim the plan of corrugating or otherwise forming the lower edge, rim, or flange of glass-chimneys, in such manner as to admit the atmospheric air inside and under the bottom of the chimney, for the purpose hereinbefore described.

38,668.—Charles D. Gibson, New York city, for a Head Light Reflector:

I claim the construction of a cylindrical curved head-light reflector, lined with several pieces of looking-glasses, or their equivalents, and arranged in regular series around the interior of the case or box, so as to reflect the rays of the light to different and distinct points, substantially as set forth and described.

38,672.—Elliott P. Gleason, New York city, for a Taper-holder for lighting Lamps:

I claim the within-described taper-holder for lighting lamps, &c., without removing the chimney, as a new article of manufacture.

38,679.—Hugh Hawkins, Lockhaven, Pa., for a Water Elevator:

I claim, first, The combination of the angular or sprocket pulley, B, chain, C, buckets, E, lever, K, and cam-block, H; all constructed and operating substantially as and for the purposes set forth.

Second, The described combination of the hinged trough, G, with the buckets, E, and trough, F, for the purpose specified.

38,687.—E. E. Matteson, Nevada, Cal., for a Centrifugal Water-Wheel. Antedated March 12, 1863:

I claim the combination of the centrifugal wheel or hollow arm with the gates or valves, together with the sliding rods, elbows, and clutch, with its connecting rods and lever, and the movable and stationary collars, substantially as shown and described.

38,693.—David P. Munroe, Plympton Station, Mass., for a Water Elevator:

I claim the arrangement of the case, E, with ratchet teeth, a, and pawl, b, in combination with the oscillating double-armed winch, F, ratchet-wheel, D, and drum, A, all constructed and operating in the manner and for the purpose shown and described.

38,695.—David S. Ogden, New York city, for a Means for making Cement Pipes. Antedated Feb. 23, 1863:

I claim, first, A series of hexagonal moulds formed by the angular or zig-zag plates, m m, set together in the manner specified so that the moulds can be taken apart with facility for the removal of the pipe as shown forth.

Second, I claim a core set and moving on the line of the centre of the mould for perforating the cement or material contained in said moulds and forming pipe as set forth.

Third, I claim a core provided with a taper or conical end to compress the material in the mould in the manner set forth, as said core is forced through the mould as and for the purposes specified.

Fourth, I claim a perforated hopper-plate, q, in combination with the moulds, m, and cores, o o, substantially as and for the purposes set forth.

Fifth, I claim the movable tubes, u u, on the cores, o o, as and for the purposes specified.

Sixth, I claim the movable sheet-metal lining, v v, in combination with the moulds, m m, for the purposes and as set forth.

Seventh, I claim the movable sheet, w, of metal or other material in combination with the moulds, m m, as and for the purposes set forth.

Eighth, I claim the movable sheet, 7, of rubber or other suitable material applied at the base of the cores, o o, for the purposes and as specified.

Ninth, I claim the arrangement of the screws, d d d d, nuts, f f f f, and screw pinions, g g, on the shaft, h, in combination with the follower, e, and cores, o o, as and for the purposes set forth.

Tenth, I claim the slings, r r, and crossbars, s s, in combination with the hopper-plate, q, and moulds, m m, as and for the purposes specified.

38,707.—G. E. & E. W. Watson, McLean, N. Y., for a Water Wheel:

We claim, first, The swing buckets, e e, in combination with the rods, f f, collar, i, and governor, g g.

Second, The operating said collar, i, and buckets, e e, when the wheel is in motion directly, by means of a governor upon the shaft of the wheel.

38,711.—Philander Anderson (assignor to himself and P. K. Bronson), Norwich, N. Y., for a Water Elevator:

I claim the pin, c, attached to the head of the crank, C, or its equivalent, and the cam recess, m, of the ratchet-ring, R, in combination with the friction flange, a, spring, s, pin, e, and pawl, P, substantially as and for the purposes specified.

38,713.—Antoine Meucci (assignor to Mrs. Esterre Meucci), Clifton, N. Y., for Preparing Hydrocarbon Liquids to serve as a Vehicle for Paints:

I claim, first, The employment or use in treating petroleum or other hydrocarbon liquids of hypochloro-nitric acid, substantially in the manner and for the purpose described.

Seventh, Mixing petroleum, kerosene, or other hydrocarbon liquid, after treating the same with hypochloro-nitric acid, with linseed oil, linseed, or linseed cakes, substantially as and for the purpose set forth.

38,729.—Hezekiah Clements, Warsaw, Ky., for a Still:

I claim the vertical shaft, H, and the paddles, k k, when used in connection with the worm, G, and steam space, a, substantially as and for the purpose described.

38,732.—David Dick, Meadville, Pa., for a Process of burning Petroleum and other Liquid Fuel for the generation of Steam and other purposes. Antedated April 25, 1863:

I claim the method of employing coal-oil, petroleum, or other mineral oils as fuel for the generation of steam or for other purposes, by saturating a bed or stratum of incombustible or refractory materials with the oil and burning it upon the surface thereof, substantially in the manner described.

38,736.—Andrew Fitzpatrick, New York city, for a Pump:

I claim the rotary screw-spindle, D, and crosshead, C, connecting by rods, a, with a piston moving in a pump-cylinder, B, in combination with the longitudinally sliding clutch, G, wheels, E E' F, and tappet rod, H, all constructed and operating substantially as and for the purpose shown and described.

38,742.—A. N. Henderson, Buffalo, N. Y., for a Lamp Burner:

I claim, first, The isolated space, D, open at the top around the flame, without air-holes around the bottom but with small holes connecting with the oil-reservoir, constructed in the manner and for the purpose described and represented.

Second, I claim the said isolated air-space in combination with the outer descending air-space, E, with the various modifications of the cap for the formation thereof, so constructed as to admit the air, as herein described, and in some of the forms at the top also, so as to throw it at right angles against the flame, and in further combination with these devices the plate, F, now in use in other forms of lamps, all constructed in the manner and for the purpose herein substantially described and set forth.

38,754.—Charles P. Lindley, Waterbury, Conn., for a Lantern Globe:

First, I claim providing a lantern globe with an opening, a, for the purpose specified.

Second, In combination with the same, I claim the lip for the purpose described.

Third, In combination with the globe provided with the opening, a, I claim the use or employment of the reflector, C, or its equivalent, for the purpose herein set forth.

38,764.—Hugh Sangster, Buffalo, N. Y., for a Head Lamp for Vessels:

I claim, first, The reflector made movable for the purpose set forth, by means of the two knobs, H and G, and the piece, K, or reflector-holder, or their equivalents.

Second, The lamp-pot so arranged that it may be moved and its position changed inside of the lamp-base by means of the knob, I, or its equivalent, on the outside of the lamp, for the purpose of adjusting it to the focus of the reflector.

Third, The manner described of attaching looking-glass and frame to the wings of the lamp, also the panel, or recess, which is stamped into the wing for its reception.

Fourth, The cone-covered hot-air tubes, as described, and the grooves for the glass, bent and formed of the same pieces of metal as the top and bottom, as shown in Fig. 3 and lettered W W' X X', also the manner of holding the fruit glass (in the door) to its place, as shown in Fig. 7, and by the piece, Y'.

38,765.—Samuel J. Seely, Brooklyn, N. Y., for a Car for carrying Petroleum, &c.:

I claim, first, A railway-car having its body composed of a corrugated or other sheet-iron cylinder, substantially as and for the purpose herein specified.

Second, The combination with the car-body of one or more pipes, k k, arranged below the car, as described, and furnished with a series of flexible branches, l l, connected by cocks, k k, substantially as and for the purpose herein set forth.

Third, The boxes, n n, arranged as described, for the protection of the cocks, k k, and for the stowage of the flexible branch-pipes, l l.

38,775.—Henry Van Dewater, Worcester, Mass., for a Water Wheel:

I claim, first, The buckets, H, constructed as shown, so as to conform to the shape of the hub, G, and provided with the lips, k, and segment flanges, I, as and for the purpose set forth.

Second, The pendent lips, m, attached to the under side of the rim, l, of the hub, G, when arranged relatively with the buckets, H, to operate as and for the purpose herein set forth.

Third, The combination of the hub, G, buckets, H, provided with the lips, k, and flanges, I, the pendent lips, m, and case, C, provided with the chutes, D', all arranged to operate as and for the purpose herein set forth.

Fourth, The inverted conical chamber, F, placed below or underneath the wheel, D, and inclosing the step of the shaft, E, as and for the purpose herein set forth.

38,791.—Thomas Shaw (assignor to himself and John L. Linton), Philadelphia, Pa., for an Apparatus for burning Fluids for the generation of Steam, &c. Antedated May 19, 1863:

I claim, first, The construction of cone, G, substantially as and for the purpose set forth.

Second, The pipe, L, or its equivalent for conducting the air downwards over the cone, G, substantially as and for the purpose specified.

RE-ISSUE.

1,488.—E. B. Requa, Jersey City, for a Lamp. Patented May 6, 1852:

I claim, first, The tube, G, made of metal with its metal deflector, H, insulated by plaster of paris, or other good non-conducting cement, or made of glass with the deflector, H, fitted upon it without cement.

Second, The tube, J, made of glass with its deflector, I, of metal insulated by plaster of paris or other good non-conducting cement.

Third, The combination of the two tubes, G J, one placed within the other and the inner one including the wick-tube, E, when said tubes are constructed with deflectors so as to admit of a space, e, between them, having a narrow passage, e', to increase the rapidity of the draught against the sides of the flame, substantially as and for the purpose herein set forth.

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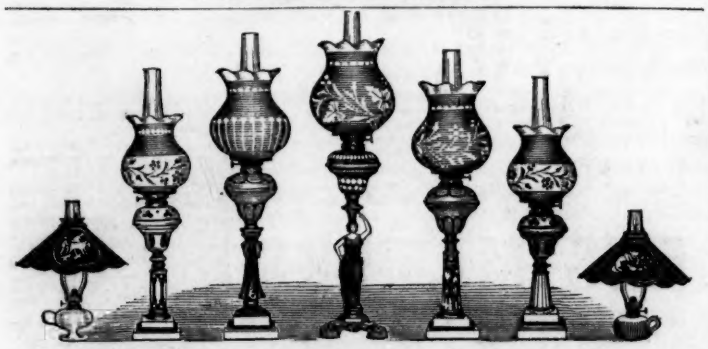

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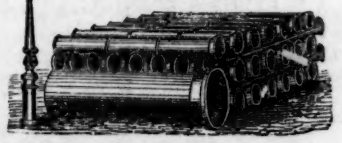

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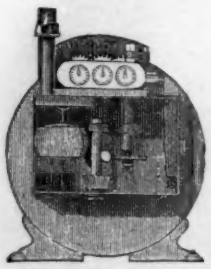

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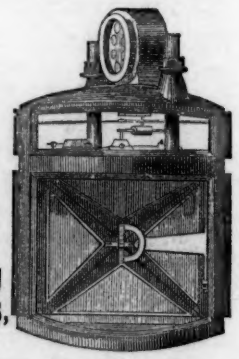

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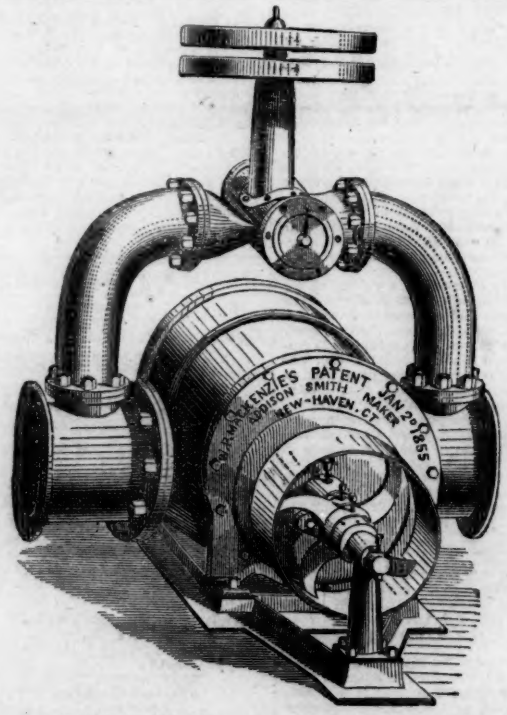

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